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PLEASE NOTE

This report presents unevaluated information extracted from recently received publications of the USSR. The information selected is intended to indicate current scientific developments and activities and is disseminated as an aid to research in the United States.

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I. BIOLOGY

Plant Physiology

1. Magnetotropism Deemed Key to the Study of Oncology, Radiology, Phosotosynthesis, etc.

"The Effect of Magnetotropism on Plants and Its Nature," by A. V. Krylov and G. A. Tarakanova, Institute of Plant Physiology imeni K. A. Timiryazev, Academy of Sciences USSR; Moscow, Fiziologiya Rasteniy, Vol 7, No 2, Mar/Apr 60, pp 191-197

The vital activity of plants is usually connected with such factors in the external environment as the temperature and humidity of the air and the soil, nutrition, duration of day and night, spectral composition of light, etc.; but constantly acting factors such as the earth's magnetic field have not yet been fully exploited. Furthermore, modern physics has established that all substances possess magnetic properties and that these properties change, depending on external factors, and cause changes in the energy levels of the chemical bonds, etc.

On the basis of the above-mentioned factors, the authors conducted the research discussed.

The authors present the following conclusions:

1. It was established that the earth's magnetic field exerts a definite effect on growth processes in plants.

2. The effect of the earth's magnetic field, as well as the effect of permanent magnets, on the vital activities of plant seedlings is most pronounced when the seeds are oriented so that their embryo roots are directed towards the magnetic poles; in this case, swelling and further growth of the seedlings takes place in the magnetic field.

3. The phenomenon of magnetotropism, which consists of the oriented growth of a root in the direction of the earth's south magnetic pole or the artificial south magnetic pole, has been established.

It is shown that the phenomenon of magnetotropism is accompanied by changes in the rate of growth of both the roots and the stem. If the embryo roots of the seedlings are oriented toward the south magnetic pole, growth of the roots and stems is accelerated; but if they are oriented in the opposite direction, then growth of both is decelerated.

The authors think that the phenomenon of magnetotropism makes it possible to state that polarity is a fundamental property of all living material, on the basis of which lay the magnetic properties of a substance. This phenomenon is the key to the study of such problems as photosynthesis, the nature of heredity, the onset of malignant growth, the harmful effect of ionizing radiations, the construction of a model of a living system, etc.

Radiobiology

2. Ionizing Radiation-Induced Toxic Substances in Growing Plants

"The Distant Effect of Ionizing Radiation in an Irradiated Plant," by L. M. Kryukova and A. M. Kuzin, Institute of Biological Physics, Academy of Sciences USSR; Moscow, Fiziologiya Rasteniy, Vol 7, No 2, Mar/Apr 60, pp 220-222

The purpose of the research described was to determine whether toxic substances are formed in the irradiated tissues of plants and whether these substances inhibit the growth and development of the growing seedling and also inhibit mitotic activity.

The method consisted essentially of shielding bean plants (Vicia faba) from x-irradiation by means of lead plates, except for one stem whose leaf protruded beyond the shielding.

The authors state that these simple experiments prove conclusively the appearance, in the irradiated tissue, of substances which, through their circulation in the plant, exert a sharp inhibiting effect on cell division at the points of growth and which inhibit the growth and development of the plant as a whole.

The authors present the following conclusions, based on the results of these experiments:

> The irradiation of a leaf of the bean plant (Vicia faba) by 10,000 and 25,000 r doses after the protective screening, not only of the points of growth, but of the whole plant, inhibited cell division at the points of growth of the stem and of the root and suppressed plant growth as a whole.
>
> The removal of the irradiated leaf immediately after its irradiation curtailed the inhibiting effect on mitosis and on plant growth.

On the basis of the above-described experiments, the authors postulate that, under the effect of ionizing radiations, toxic metabolites are formed in the leaf and, through their circulation in the plant, exert an inhibiting effect on cell division at the points of growth of the stem and of the root and, consequently, on the growth of the plant as a whole.

3. Certain Qualities of Meat Irradiated by Preservative Doses of Ionizing Radiations

"The Question of the Hygienic Evaluation of the Quality of Meat Irradiated by Ionizing Radiations," by I. M. Buznik, Chair of General and Military Hygiene, Military Medical Order of Lenin Academy imeni S. M. Kirov; Moscow, Voprosy Pitaniya, Vol 19, No 2, Mar/Apr 60, pp 63-69

The purpose of this research was to study the hygienic indexes of the quality of meat of warm-blooded animals which has been irradiated by preserving doses of gamma rays.

The author reviews the research in the field of food irradiation for storage and preservation and discusses the various chemical processes induced by different doses of irradiation and responsible for changes in the color and taste of fresh and treated (cooked) meat.

The author presents the following conclusions:

1. The irradiation of fresh meet by preserving doses of gamma rays causes insignificant changes in its color and in the development of unpleasant and strange odors. Irradiation in a vacuum and under refrigeration causes insignificant organoleptic changes. The cooking of irradiated meat does not always fully rid it of the unpleasant odor. The irradiation of cooked meat produces insignificant organoleptic changes.

2. Meat irradiation leads to a slight increase of its aminonitrogen and ammonia content. Fractional determinations of aminonitrogen and of ammonia indicated a rise in both of these indexes.

3. Seedings from washings of meat irradiated by a total dose of 1.5-2.0 millions r produced no microbial growth. Growth of cocci was noted in meat irradiated by 200,000-500,000 r doses. The number of microorganisms was counted in tens and hundreds per gram, but in unirradiated meat, it was counted in tens and hundreds of thousand per gram. Upon the addition to the meat of a suspension from a pure culture of B. anthracoides, the growth of the microorganisms was noted even in samples irradiated by 1.5-2.0 millions r.

4. Irradiation of Pork

"Biochemical Changes in Pork When Sterilized by Gamma-Radiation," by V. V. Pal'min, N. K. Zhuravskaya, and L. T. Alekhina, Moscow Technological Institute of the Meat and Dairy Industries; Krasnodar, Pishchevaya Tekhnologiya, No 6, Nov/Dec 59, pp 89-94

The results of the subjection of pork to ionizing radiation by sterilizing doses of Co^{60} are reported. It was found that in sterilizing pork with gamma rays, the vitamins riboflavin and niacin are well preserved, but thiamine is destroyed; the activity of succino-dehydrogenase is reduced to about 60 percent of normal; the change in the color of the meat is due to the fact that some of the hemochromogen is destroyed; the glutathione content in the meat is not disturbed; and there is an increase in moisture absorption and some increase in pH value.

Fuels and Propellants

5. Hydroxylamine Perchlorate

"Hydroxylamine Perchlorate," by A. A. Zinov'yev and I. A. Zakharova; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 4, Apr 60, pp 775-777

Hydroxylamine perchlorate is synthesized by reacting hydroxylamine sulfate with barium perchlorate in an aqueous solution. Hydroxylamine perchlorate with a purity of 99.2% was prepared in this manner. Its specific weight was determined and found to be $d^{20} = 1.77$. By using the visual polythermic and thermographic methods, the heat effects have been investigated which take place in connection with the thermal decomposition of hydroxylamine perchlorate. The temperature limits were determined within which two exothermic effects and one endothermic effect appear.

Hydroxylamine perchlorate is unstable when subjected to shock or friction. On being heated, this salt decomposes with a flash, but no explosion takes place. The first exothermic effect (at approximately 180°) is accompanied by an evolution of gas. It was established that the gas in question consists entirely of oxygen. One may correlate the first exothermic effect with a decomposition taking place according to the equation

$$(NH_3OH)ClO_4 = NH_4ClO_4 + 0.5\ O_2 \quad .$$

The results reported in this article were obtained in work carried out in 1954, i.e., 2 years before the granting of US patent No 2768874 to J. Robson and H. John. No other information on hydroxylamine perchlorate, besides that given in the US patent, has been published prior to this.

6. Interaction of Sodium Peroxide and Sodium Superoxide With Sodium Carbonate

"The Interaction of Sodium Peroxide and Sodium Superoxide With Sodium Carbonate," by T. V. Rode and A. V. Cachatskaya, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 3, Mar 60, pp 524-528

The value of sodium peroxide and sodium superoxide in practical application is based on the capacity of these compounds to absorb carbon dioxide and water vapor, evolving oxygen during the process of absorption. The investigation described in this instance was carried out for the purpose of establishing the behavior of the peroxide and superoxide toward the products of these reactions, viz., sodium carbonate and sodium hydroxide. It was found that in the absence of moisture neither sodium peroxide nor sodium superoxide reacts on being heated with dry sodium carbonate.

7. Interaction of Sodium Peroxide and Sodium Superoxide With Sodium Hydroxide

"Interaction of Sodium Peroxide and Sodium Superoxide With Sodium Hydroxide and the Hydrates of Sodium Hydroxide," by T. V. Rode, G. K. Grishenkova, and A. V. Zachatskaya, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 3, Mar 60, pp 529-534

It was established that sodium superoxide in the absence of moisture does not react with anhydrous sodium hydroxide, but decomposes, forming Na_2O_2 below the melting point of sodium hydroxide. The interaction of sodium peroxide with sodium hydroxide in the absence of moisture begins at the melting point of sodium hydroxide (i.e., at about 300-310°). Molten hydroxide, on reacting with the sodium peroxide, induces evolution of oxygen and, by dissolving up to 15% of the Na_2O that has formed, forms a homogeneous phase consisting of sodium oxide and sodium hydroxide. The excess of the peroxide decomposes with evolution of oxygen when the temperature has been raised further. When a hydrate of sodium hydroxide is used or moisture is present, both the superoxide and peroxide decompose with the evolution of the corresponding quantity of oxygen at the melting point of the monohydrate of sodium hydroxide (i.e., at about 63°) and at the temperature of the dehydration of sodium hydroxide hemihydrate (at about 170°).

8. Interaction of Sodium Peroxide and Sodium Superoxide With Sodium Bicarbonate

"The Interaction of Sodium Peroxide and Sodium Superoxide With Sodium Bicarbonate," by T. V. Rode, G. A. Gol'der, and A. V. Zachatskaya, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences SSSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 3, Mar 60, pp 535-539

The interactions which take place on heating of sodium superoxide and sodium peroxide with sodium bicarbonate were investigated. It was established that the thermal decomposition of sodium bicarbonate begins at 100-120° rather than 270°, as indicated in handbooks. It was found that neither sodium superoxide nor sodium peroxide reacts with sodium bicarbonate itself. An interaction begins at 100° with products of the thermal decomposition of the bicarbonate, namely, water and carbon dioxide. The product of the interaction both with the peroxide and the superoxide is either sodium carbonate alone, if an excess of sodium bicarbonate was present, or sodium carbonate together with sodium hydroxide, if an excess of sodium peroxide or sodium superoxide was present in the initial mixture. In the first case (i.e., when an excess of sodium bicarbonate is present), there is evolution of water, carbon dioxide, and oxygen. In the second case (i.e., in the presence of an excess of peroxide or superoxide), there is evolution of oxygen only.

9. Effects of Aluminum on the Constants of the Detonation of Explosives

"Effects of Aluminum on the Constants of the Detonation of Trotyl /TNT/," by A. N. Dremin, P. F. Pokhil, and M. I. Arifov, Institute of Chemical Physics, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 131, No 5, 11 Apr 60, pp 1140-1142

Using a method described earlier by Dremin and Pokhil (cf Doklady Akademii Nauk SSSR, Vol 128, No 5, 1959), the effects of Al, SiO_2, and W of different degrees of dispersion on the constants of the detonation wave of trinitrotoluene (TNT) in the Chapman-Jouguet plane were measured. Experimentally determined velocities of products formed in the detonation wave were compared with those calculated by the formula

$$u = u_o \rho_o / \rho_1 ,$$

where u_o is the velocity of explosion products of pure TNT when its density in the charge is ρ_o and ρ_1 is the density of the mixture used. This formula describes accurately velocities of explosion products formed by TNT to which inert ingredients have been added. It follows from the results obtained that aluminum does not increase the intensity

of the detonation wave, in spite of an earlier finding that explosives which contain a small quantity of aluminum develop more heat during the explosion (for instance, it has been established by A. Ya. Apin and Yu. A. Lebedev that the heat developed in hexogen explosions is increased by as much as 30% as a result of the addition of aluminum to the hexogen -- cf the collection of articles Fizika Vzryva /Physics of Explosions/, No 5, 1956). The experimental data obtained indicate that aluminum reacts in the detonation wave to a degree which depends on its particle size. The lowering of detonation constants by aluminum is greater than that which would correspond to withdrawal of the heat required for heating the aluminum to the ambient temperature. S. B. Ratner's and Yu. B. Khariton's assumption to the effect that the lowering of the intensity of the detonation is due to evaporation of Al_2O_3 formed from the aluminum is incorrect: Al_2O_3 is incapable of existing in the vapor state and decomposes with the formation of AlO, which is also unstable and decomposes in its turn, forming Al_2O.

On the basis of the experimental data which are available, one must assume that at high densities of the charge, aluminum of all particle sizes behaves as an inert substance. As the density of the charge is lowered, aluminum begins to react. Because lower oxides of aluminum are formed, the heat of formation of which is low (39 kilocalories per mol for Al_2O in contrast to 393.1 kilocalories per mol for Al_2O_3), and because oxygen originally contained in other substances is used up in the course of the formation of aluminum oxides, the total effect produced by the aluminum is endothermic.

It is possible that at sufficiently low densities of the charge, lower oxides of aluminum will be transformed into Al_2O_3 in the reaction zone with the result that the intensity of the detonation wave will be increased rather than lowered.

10. Effect of the Initial Temperature on the Value of the Critical Diameter of Nitroglycerine and Trotyl

"The Effect of the Initial Temperature on the Value of the Critical Diameter of Nitroglycerine and Trotyl," by A. F. Belyayev and R. Kh. Kurbangalina, (Moscow) Institute of Chemical Physics, Academy of Sciences USSR; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 3, Mar 60, pp 603-610

The critical diameter of nitroglycerine (glycerine trinitrate), liquid trotyl (trinitrotoluene), and trotyl powder has been investigated with respect to the initial temperature. On raising the latter, the critical diameter of nitroglycerine and liquid trotyl was found to diminish. Thus when the initial temperature of nitroglycerine was raised

from minus 20 to 70°, the critical diameter fell from 3.9 to 1.1 mm. In the case of liquid trotyl, a rise in the initial temperature from 81 to 240°C leads to a decrease in the critical diameter from 62 to 6 mm.

Based on the values obtained for the critical diameters, it was concluded that in the vicinity of the flash point of trotyl, the latter should approach nitroglycerine (at room temperature) with respect to detonation capacity, sensitivity, etc.

If it is assumed that liquid trotyl and nitroglycerine detonate because of heat evolution through compression with subsequent homogeneous reaction, then the temperature generating a shock wave (initial temperature of chemical reaction) should be of the order of 1100-1200°K.

11. Diffusion of Monoatomic Gases Through Polymer Films of Different Structure

"Studies on Diffusion Processes in Polymers; Part 1 --- Diffusion of Monoatomic Gases Through Polymer Films of Different Structure," by N. S. Tikhomirova, Yu. M. Malinskiy, and V. L. Karpov, Scientific Research Institute of Plastics, Physico-chemical Institute imeni L. Ya. Karpov; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 2, Feb 60, pp 221-229

The diffusion of helium and argon through polyethylene, polyvinyl chloride, polyamide 54/10, methylolpolyamide 2/10, polytetrafluoroethylene, and butadiene-30% styrene (SKS-30) has been studied at various temperatures with the aid of Daynes' manometric method.

The assumption that the diffusion constants of argon diminish in value with growing intermolecular interaction has been confirmed. The diffusion constants D have been shown to fall with an increase in the packing coefficient of the polymer chains.

The lowest diffusion constants of argon and the highest activation energy of diffusion are observed with polyamides and polytetrafluorethylene.

The polymers are arranged in the following order with respect to the magnitude of increase of ΔH and ΔS: polytetrafluorethylene, SJS-30, methylolpolyamide 2/10 polyamide 54/10, polyethylene, polyvinylchloride.

The ΔH and ΔS values of dissolution of the gas in the polymer may serve as qualitative characteristics of the degree of flexibility of the chains.

12. Studies on Diffusion Processes in Polymers

"Studies on Diffusion Processes in Polymers; Part 2 -- The Effect of the Atomic Diameter on Gaseous Diffusion in the Polymer," by N. S. Tikhomirova, Yu. M. Malinskiy, and V. I. Karpov, Scientific Research Institute of Plastics, Physicochemical Institute imeni L. Ya. Karpov; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 2, Feb 60, pp 230-237

A study has been made of the diffusion of He, Ar, Ne, Xe through polyethylene and polyamide 54/10 at various temperatures.

The diffusion constants (D) and the activation energy of diffusion (E_D) of these gases depend upon their atomic diameters. An increase in the latter by 1.43 A causes a fourfold decrease in D and twofold increase in E_D. The relation between the heat of solution and the atomic diameter of the gas is expressed by the following empirical equations: H = 3.9d - 3.8 for polyethylene, H = 5.0d - 7.4 for polyamide 54/10.

It was shown by extrapolation that there is a temperature region in which the dependence of the solubility of monoatomic gases in the polymer upon the diameter reverses. For polyethylene, this occurs at minus 10 - 0°; for the polyamide 54/10, at 115-117°.

13. Alkylation of Benzene by Propylene in the Presence of Aluminum and Hydrogen Fluoride

"Laws of the Substitution of Alkyl for Hydrogen in the Benzene Nucleus; Part 8 -- On Equilibrium in the Processes of Alkylation of Benzene by Propylene in the presence of Aluminum and Hydrogen Fluoride," by V. G. Plyusnin and Ye. P. Babin, (Sverdlovsk), Ural Affiliate of the Academy of Sciences USSR; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 1, Jan 60, pp 78-82

The alkylation of benzene by olefins has been shown to be an equilibrium reaction. Alkylation carried out in the presence of hydrogen fluoride is irreversible in all excepting the last of the stages of the consecutive reaction. Alkylation in the presence of aluminum chloride is reversible in the first, second, and fourth stages. The third stage is irreversible.

A study has been made of the composition of the products of dealkylation of alkylbenzenes in the presence of aluminum chloride. The composition has been shown to approach that of the alkylate obtained on alkylating benzene at molar olefin-benzene ratios, corresponding to the number of alkyl groups in the initial alkylbenzene.

14. Physical Chemistry of Concentrated Ozone

"The Physical Chemistry of Concentrated Ozone VIII. On The Thermal Propagation of Flame in Gaseous Mixtures of Ozone," V. V. Yastrebov (Moscow), Moscow State University; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 1, Jan 60, pp 46-50

The results of experimental study on the concentration boundaries of explosibility for gaseous mixtures of ozone described in a previous report have been discussed from the standpoint of the thermal mechanism of flame propagation. The main assumption is that the heat (q) from the already burned gas layers is partially (q_1) consumed in heating subsequent layers and partially (q_2) lost as the result of thermal conductivity. It is postulated that q, q_1, and q_2 are proportional, respectively, to (1) the ozone content of the mixture, (2) to the heat capacity, and (3) to the thermal conductivity of the mixture. An equation derived on the basis of these assumptions describes the position of the boundaries of explosibility for pressures close to atmospheric if it be also assumed that nonequilibrium distribution of energy takes place among the degrees of freedom of the molecules (the vibrational degrees of freedom are not excited).

The relations derived make it possible to estimate the value of the thermal conductivity coefficient for gaseous ozone (ca. 4.5×10^{-5} cal/cm.sec.deg) from the boundaries of explosibility.

15. Catalytic Oxidation of Ammonia in Nonaqueous Solutions

"Catalytic Oxidation of Ammonia in Nonaqueous Solutions; Part 1 -- Catalysts of the First Group of Mendeleyev's Periodic System," by S. I. Papko (Moscow), Second Moscow State Medical Institute imeni N. I. Pirogov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 1, Jan 60, pp 162-167

Approximately 25 substances representing compounds of the first subgroup elements of the periodic system have been investigated as catalysts of the oxygen oxidation of ammonia dissolved in carbon tetrachloride. Univalent copper compounds (with oxygen and sulfur) have been found to be more active than the bivalent copper analogs. Metallic copper assumes an intermediate position. As a rule, the method of preparing the catalyst affects its activity. Silver had a promoting influence on copper monoxide. Additions of nickel to the copper lowered its activity. Copper monoxide preserves its activity on repeated saturation of the initial solution with ammonia. The application of copper to an inert carrier had no effect on the activity of the former, although the quantity of copper diminished by

about 100 times. Hence only part of the copper surface is catalytically active. NO_3^- is always present and NO_2^- always absent among the oxidation products. In most cases, chlorine ions may be detected.

Isotopes

16. Kinetics of Deuteroexchange Between Monodeuterotoluene, Monodeuterodiphenyl, and Monodeuteronaphthalene Isomers With Liquid Hydrogen Bromide and With Potassium Amide in Liquid Ammonia Solution

"Kinetics of Deuteroexchange Between Monodeuterotoluene, Monodeuterodiphenyl, and Monodeuteronaphthalene Isomers With Liquid Hydrogen Bromide and With Potassium Amide in Liquid Ammonia Solution," by E. N. Yurygina, P. P. Alikhanov, Ya. A. Izrailevich, P. N. Manochkina, and A. I. Shatenshteyn (Moscow), Physical Chemistry Institute imeni L. Ya. Karpov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 3, Mar 60, pp 587-593

The partial rate factors of deuteroexchange between monodeuterotoluene, monodeuterodiphenyl, and monodeuteronaphthalene derivatives and hydrogen bromide, as well as 0.02 N potassium amide in liquid ammonia at 25°, have been determined. The sequences of the partial rate factors of isotopic exchange between nonequivalent deuterium atoms in toluene and diphenyl molecules are not the same for reactions with acid and with base owing to the difference in mechanisms of these reactions, in which, to a large extent, are manifested the different aspects of the mutual influence of atoms in the hydrocarbon molecule, namely, the conjugative and inductive effects. In naphthalene, the alpha-position is the most reactive, independently of the reactant. This is ascribed to the specific features of polarization of the naphthalene molecule. Liquid hydrogen bromide has been shown to be a solvent accentuating the difference in reactivities of nonequivalent hydrogen atoms, whereas potassium amide in liquid ammonia solution, on the contrary, levels them off. A method for the synthesis of monodeuterodiphenyl isomers has been described.

Nuclear Fuels and Reactor Construction Materials

17. Prospecting Criteria To Be Applied in Searching for Uranium Deposits

"Prospecting Criteria To Be Applied in Searching for Uranium Deposits," by M. M. Konstantinov (deceased); Moscow, Atomnaya Energiya, Vol 8, No 3, Mar 60, pp 228-238

This article discusses prospecting criteria which can be applied in evaluating the prospects of finding uranium in definite regions and also in actually locating uranium deposits and individual uranium ore agglomerations.

18. Polarography of Uranium Carbonates

"The Polarography of Compounds Formed by Uranium in Carbonate and Bicarbonate Solutions -- Reduction Waves of Complex Uranyl Carbonate Ions," by A. I. Stabrovskiy; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 4, Apr 60, pp 811-820

The polarographic waves corresponding to the reduction of complex U (VI) carbonate ions at a mercury drop cathode in carbonate and bicarbonate solutions were investigated. The mechanism of the reduction of U (VI) to U (IV) and of the formation of U (V) from U (VI) + U (IV) are interpreted on the basis of the results obtained. Conclusions are drawn in regard to the role played by complex carbonate ions in the reactions involved. It was established that the carbonate ions of U (IV) and U (V) undergo hydrolysis. The hydrolyzed forms of these ions lose the capacity of being reduced at the mercury drop cathode. However, they are readily oxidized.

19. Solubility of the Hydroxide of Uranium (IV) in Sodium Hydroxide

"Solubility of the Hydroxide of Uranium (IV) in Sodium Hydroxide," by N. P. Galkin and M. A. Stepanov; Moscow, Atomnaya Energiya, Vol 8, No 3, Mar 60, pp 258-261

Contrary to the opinion held until recently, the hydroxide of tetravalent uranium is not purely basic: it has the properties of an amphoteric compound. The solubilities of uranium (IV) hydroxide in aqueous solutions of sodium hydroxide were investigated. It was established that all traces of sodium or potassium can be washed out of uranium hydroxide precipitates. Investigation of the chemical composition of the solid phase in the system uranium (IV) hydroxide-aqueous sodium hydroxide led to the conclusion that the hitherto unknown compound NaH_3UO_4 exists and that this compound undergoes hydrolysis.

20. Catalytic Effect of Iron Compounds on the Oxidation of Tetravalent Uranium in Acidic Media

"The Catalytic Effect of Iron Compounds on the Oxidation of Tetravalent Uranium in Acidic Media," by V. I. Spitsyn, G. M. Nesmeyanova, and G. M. Alkhazashvili; Moscow, Atomnaya Energiya, Vol 8, No 3, Mar 60, pp 261-262

A quantitative investigation was made of the oxidation of tetravalent uranium in the presence of ferric and ferrous sulfates. Manganese dioxide and potassium chlorate were used as oxidants. It was established that ferrous oxide exerts a catalytic effect on the oxidation of tetravalent uranium, i.e., the ferrous ions act as transmitters of electrons from the oxidant to uranium.

21. Extraction of Uranium From Hydrochloric Acid Solutions With Tributylphosphate

"Extraction of Uranium From HCl Solutions With Tributylphosphate," by V. M. Vdovenko, A. A. Lipovskiy, and S. A. Nikitina; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 4, Apr 60, pp 935-940

The extraction of uranium with tributylphosphate (TBP) from hydrochloric acid solutions and the effect of the concentration of hydrochloric acid on this extraction were investigated. It was established that TBP extracts uranium in the form of $H\left[UO_2Cl_3\right]$. The content of this coordination compound in the organic phase increases with increased concentrations of HCl in the aqueous solution. Investigation of the distribution of uranium and HCl depending on the concentration of TBP in benzene indicated that uranyl chloride is extracted in the form of $UO_2Cl_2 \cdot 2$ TBP from 1.0 - 10.7 M solutions of HCl. Absence of significant concentrations of the trichloride complex of uranyl in the organic phase at low concentrations of TBP may be due to a lack of HCl in this phase. By using a graphic method, it was demonstrated that after extraction from a 6.25 M solution of hydrochloric acid, the HCl is transferred into the organic phase in the form of HCl. 2 TBP.

22. Binary System Sodium Perchlorate-Lithium Perchlorate

"Fusibility Diagram of the Binary System $NaClO_4$ - $LiClO_4$," by I. A. Zakharova, V. G. Markova, and A. A. Zinov'yev; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 4, Apr 60, pp 914-916

It was established that the system consisting of sodium perchlorate and lithium perchlorate forms a simple eutectic containing 71.5 mol-% of Li Cl O_4. The melting point of this eutectic is 204.5°. Data have been obtained which indicate that solid solutions form within the system.

23. The Double Yttrium-Ammonium Nitrate

"Investigation of Solubilities in the System $Y(NO_3)_3$ - NH_4NO_3 - H_2O at 25° and 50°," by F. M. Perel'man, A. Ya. Zvorykin, and G. A. Demina, Institute of General and Inorganic Chemistry imeni S. Kurnakov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 4, Apr 60, pp 960-963

The solubility isotherms in the system $Y(NO_3)_3$ - NH_4NO_3 - H_2O at 25° and 50° were determined. It was established that the salt $Y(NO_3)_3 \cdot 2\ NH_4NO_3$ forms at 50° but does not form at 25°. The concentrations at which this salt forms and its solubility were determined. Information on double salts formed by lanthanide nitrates with ammonium nitrate is of importance because the fractional crystallization of such salts is applied in the extraction of lanthanides from minerals and ores and the separation and purification of lanthanides.

24. Solubilities of Monohydrogen Plutonium (IV) Diphosphate in Some Acids

"Solubility Product of Monohydrogen Plutonium (IV) Diphosphate and Solubilities of This Salt in Some Acids," by R. G. Denotina, A. I. Moskvin, and V. B. Shevchenko; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 4, Apr 60, pp 805-810

The solubilities of monohydrogen Pu (IV) diphosphate in HCl O_4 and HNO_3 were determined in the concentration range of 0.1 - 2 mols. It was found that the solubility of $Pu(HPO_4)_2 \cdot x\ H_2O$ increases with increased concentrations of hydrogen ions. It is higher in nitric acid because of the formation of complexes with NO_3^- ions. The solubility product of the plutonium phosphate was calculated from experimental data on solubilities in acids. This product was found to be equal to 2×10^{-28}.

25. Mass-Spectrometric Analysis and Identification of Technetium

"Mass-Spectrometric Analysis and Identification of Technetium," by G. M. Kukavadze, R. N. Ivanov, V. P. Meshcheryakov, Yu. G. Sevast'yanov, B. S. Kir'yanov, V. I. Galkov, and A. P. Smirnov-Averin; Moscow, Atomnaya Energiya, Vol 8, No 4, Apr 60, pp 365-367

Technetium is of interest from the standpoint of application as a corrosion inhibitor in reactor construction and in other fields of industrial technology. The isotopes of this element with the order numbers 97, 98, and 99 have a long half-life. The last-mentioned isotope forms in nuclear reactors as a product of the fission of uranium and plutonium. Its yield is relatively high (it reaches 6.5%) so that considerable quantities of technetium accumulate in the fuel elements. In the analysis of technetium, it is very important to distinguish this element from neighboring elements in the periodic system which also form as a result of fission, namely, zirconium, niobium, molybdenum, and ruthenium. In the work described in this instance, technetium was isolated from spent fuel elements of the reactor at the first USSR nuclear electric power station. It was separated by the extraction method. In addition to being identified by the methods of spectrophotometry, radiometry, and emission spectral analysis, the technetium obtained in this manner was investigated on the mass-spectrometer. The original method developed by the authors for the mass-spectrometric analysis of technetium is described.

26. Operation of Turbines on Organic Liquids Heated in Nuclear Reactors

"Feasability From the Thermodynamic Standpoint of the Operation of Turbines on Organic Liquids Heated in Nuclear Reactors," by P. I. Khristenko; Moscow, Atomnaya Energiya, Vol 8, No 3, Mar 60, pp 214-219

This article discusses the theoretical possibility of using heated organic liquids for the operation of turbines. As liquids of this type, diphenyloxide, biphenyl, dowtherm, and others can be used. The heating of the liquids is carried out in power-generating reactors. Evaporation of the liquid takes place in the nozzle of the turbine. On adiabatic expansion, the vapors of such liquids become superheated, although the temperature of the vapor drops. As an example, the parameters of the thermodynamic cycle of a power-generating reactor are considered in which dowtherm is used as the heat-transfer agent.

27. Infrared Absorption Study of Uranyl Salt Solutions in Organic Solvents

"Infrared Absorption Study of Uranyl Salt Solutions in Organic Solvents -- The Spectra of Coordination-Bound Water in Hydrated Uranyl Nitrate in the Region of Valence Vibration Frequencies," by V. M. Vdovenko and D. N. Suglobov (Leningrad); Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 1, Jan 60, pp 51-56

With the purpose of studying the forms of existence of uranyl salts in organic solvents, measurements were made of the infrared absorption spectra of solutions of hydrated uranyl nitrates (with various isotope modifications of water) in ethyl ether, β , β' -dichlorodiethyl ether, dipropyl sulfide, acetonitrile, and nitromethane in the region of the OH (OD) valence vibrations. Based on the results obtained, the conclusion has been drawn that the water in the coordination sphere of hexavalent uranium is polarized and that acid-base types of linkages are formed between the hydrate water and the solvent molecules. When additional water molecules are coordinated with the dihydrate of uranyl nitrate, they are less firmly bound to uranium than the first two molecules. The acidity of the water coordinated with uranyl nitrate confirms the similarity of the mechanisms of ether extraction for the hydrates of uranyl nitrate, on the one hand, and for acids and metal-acid complexes, on the other.

28. Work on the Chemistry of Nuclear Fuels and Reactor Materials To Be Done at the Siberian Branch of the Academy of Sciences USSR

"Scientific Developments at the Siberian Branch of the Academy of Sciences USSR" (editorial); Novosibirsk, Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSR, No 1, Feb 60, pp 3-16

The following work will be done at institutes of the Siberian Branch, Academy of Sciences USSR, under the current Seven-Year Plan.

Investigation of rare elements, metals, and alloys with special properties that are of importance for new technological applications will be conducted under the direction of A. V. Nikolayev, Corresponding Member Academy of Sciences USSR; G. B. Bokiy, Corresponding Member Academy of Sciences USSR; B. V. Ptitsin, Doctor of Chemical Sciences; and T. V. Zabolotskiy, Candidate of Technical Sciences.

Methods will be developed for the complete conversion of fluorite-beryllium and niobium-tantalum ores. The rare elements contained in these ores will be extracted. To obtain ultrapure compounds of rare-earth elements and also of silver and gold, extraction methods, high-temperature distillation procedures, and zone-refining methods will be

perfected. Progress in the crystal chemistry of inorganic substances, involving investigation of the optical, semiconductor, magnetic, and other properties of the substances in question, will advance the production of materials required by the new technology.

In the field of radiochemistry, work conducted under the direction of A. V. Nikolayev and G. K. Boreskov, Corresponding Members of the Academy of Sciences USSR, will be concerned with the investigation of a wide range of chemical and physico-chemical properties of the compounds of uranium, plutonium, and neptunium for the purpose of finding ways for the peaceful utilization of nuclear energy. Work on radiation chemistry will be expanded greatly in order to clarify conditions under which free radicals are formed as a result of irradiation, to develop a scientific basis for the application of radiation in the synthesis of chemical substances, the formation of which requires large amounts of energy, and to find ways of controlling the course of chemical reactions.

29. Radiometric Methods Applied in Mining and Prospecting

"Integrated Radiometry in Mining," by I. M. Tanenbaum; Moscow, Atomnaya Energiya, Vol 8, No 4, Apr 60, pp 336-339

Methods for the integrated application of radiometry in connection with mining are reviewed. These methods are correlated with actual conditions encountered in mining and geology. The optimum variables are given which assure the greatest effectiveness of quantitative and qualitative radiometric measurements carried out at mines. Under consideration of the great diversity of uranium deposits, these deposits are classified on the basis of specific types of radiometric methods and results that can be obtained by applying these methods. The most effective ways of carrying out radiometric measurements are given. The principles expounded in the article can be utilized for planning radiometric prospecting in connection with the opening up of new mining enterprises. The article is of practical and scientific interest to miners, geologists, and geophysicists who are active in the prospecting for and development of uranium deposits, as well as the designing of mining and ore-treatment enterprises.

30. Zirconium as a Material for Nuclear Reactors

"Properties of Zirconium as a Material for the Construction of Reactors and the Production of Zirconium," by Engr E. Praceus, Chamber of Technology, Berlin, and Bergmann-Borsig People-Owned Enterprise; Berlin, Fertigungstechnik und Betrieb, Vol 10, No 2, Feb 60, pp 104-109

Zirconium as a construction material for reactors is discussed with regard to the following aspects: its suitability for reactors in which light or heavy water is used as coolant or moderator and high pressures are encountered in the temperature range of 250-300°; the effects of radiation on zirconium and zirconium alloys; corrosion of zirconium in water and acids; working of zirconium and its alloys; and welding of zirconium and its alloys. It is suggested that the following problems must be solved in connection with the application of zirconium as a rector construction material:

1. More efficient industrial processes for the separation of hafnium from zirconium must be developed;

2. The stability of zirconium to the action of radiation must be investigated more extensively;

3. Deterioration of zirconium used as a construction material is pressurized water reactors operating at 250-310° and using natural or enriched uranium as fuel must be investigated more thoroughly;

4. Because it is desirable to operate reactors at higher coolant temperatures, a zirconium alloy must be developed which will withstand the more rigorous conditions encountered at these temperatures;

5. More data must be obtained on the mechanical properties of zirconium and zirconium alloys;

6. Procedures and equipment must be developed for the efficient welding of zirconium in vacuum.

Physical Chemistry

31. Method of Contactless Thermography

"A Method of Contactless Thermography," by N. A. Nedumov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 1, Jan 60, pp 184-191

The principal instrumental parts of the method are the "cross" and differential resistance thermometers, the reference optical pyrometer, the recording device of the Kurnakov pyrometer, and a special high temperature vacuum oven with constant heating and cooling rate control.

The change in state of the body under investigation is recorded by the change in the heat flow within the chamber in the center of which the body is placed. The change in the heat flow is detected from the recording of $\Delta t = F(\tau)$, where Δt is the temperature difference between the cavities of the "specimen" and the "reference" chambers. The temperature of the substances is measured from that of the inner cavity of the "specimen" chamber during heating and cooling at constant rates and is recorded as $t = F(\tau)$ or as markings-along the time axis (τ) of the differential curve.

The joint use of these means permitted measurement of temperature over the range 20-2800°C to be measured with an error of 0.2-0.8% and with sensitivity of the differential recording of not less than 0.001%. At the same time, various side influences such as thermal, electroconductivity, incomplete radiation, and interstitial medium effects are compensated for.

Radiation Chemistry

32. Conversions of Carboxylated Butadienestyrene Rubbers Under the Action of α-Radiation

"Conversions of Carboxylated Butadienestyrene Rubbers Under the Action of α-Radiation," by B. A. Dogadkin, I. Mladenov, and I. A. Tutorskiy, Moscow Institute of Fine Chemical Technology; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 2, Feb 60, pp 259-264

On irradiating carboxylated butadienestyrene rubbers containing 1.30 and 1.60% methacrylic acid at 30% styrene content and 2.88 and 5.34% methacrylic acid at 50% styrene content with a Co^{60} source in doses of 0.1 - 50 megaroentgens, the carboxyl groups are found to disappear, the

process being especially rapid at low doses. The radiation-chemical yield of the cross-linking reaction in the case of low dosages depends linearly upon the carboxyl group content of the initial polymer. With doses up to 20 mr, satisfactory agreement is obtained between the number of cross linkages formed by the carboxyl groups calculated from maximum swelling data and that calculated from the number of carboxyl groups consumed.

33. Polymerization of Trifluorochloroethylene

"Use of the Energy of Ionizing Radiation in the Process of the Polymerization of Trifluorochloroethylene-Polymerization of Trifluorochloroethylene as Such and Dissolved in Solvents Containing Chlorine," by A. V. Fokin, Ye. V. Volkova, and A. D. Sorokin; Moscow, Khimicheskaya Nauki i Promyshlennost, Vol 4. No 6, Dec 59, pp 806-807

The radiation-chemical polymerization of trifluorochloroethylene was investigated using gamma radiation emitted by cobalt. Polymerization of the pure monomer and of the monomer dissolved in chloroform, carbon tetrachloride, and $CFCl_2CF_2Cl$ was studied. The velocity of polymerizations, the radiation-chemical yield as affected by the magnitude of the dose, and the dependence of the molecular weight of the polymer on the magnitude of the dose, as well as the ratio between monomer and solvent, were determined. It was established that the process of polymerization of trifluorochloroethylene under the influence of radiation proceeds by a radical-chain mechanism. It was furthermore established that by using ionizing radiation to polymerize trifluoroethylene, one may obtain polymers with predetermined properties ranging from solid resins to wax-like substances. As a result of the work which had been carried out, it was confirmed that trichlorofluoroethylene can be polymerized both as such and in solution by applying radiation doses of low magnitude. It is concluded that the radiation-chemical polymerization of trichlorofluoroethylene appears promising from the standpoint of technical application.

34. Effects Produced by Gamma Rays on the Color and Transparency of Glass

"Changes in the Color and Transparency of Glasses as a Result of Irradiation With Gamma Rays Emitted by a Co^{60} Source or a Nuclear Reactor," by S. M. Brekhovskikh; Moscow, Atomnaya Energiya, Vol 8, No 1, Jan 60, pp 37-43

Various types of glass are used extensively in technology for protection against radiation. In connection with this, the problem in regard to the action of different types of radiation on glasses is of interest from the standpoint of the selection of the type of glass which is most resistant to the effects of radiation. The present article deals with

this subject. Results of experimental investigations on the irradiation of glass with gamma rays emitted by Co^{60} and the testing of glass in nuclear reactors are reported. Glasses produced by a number of USSR plants and having different compositions were investigated. Methods of increasing the resistance of glass to radiation are proposed in the article. Characteristics of glasses are given which determine the behavior of the glass being irradiated. These characteristics comprise the stability factor, the saturation index, minimum transparency, and the coefficient of the intensity of darkening.

Radiochemistry

35. Method of Investigating the Mechanism of Fast Reactions in a Turbulent Reactor With the Aid of Tracer Atoms

"A Method of Investigating the Mechanism of Fast Reactions in a Turbulent Reactor With the Aid of Tracer Atoms," by A. M. Brodskiy, R. A. Kalinenko, and K. P. Lavrovskiy; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 1, Jan 60, pp 192-195

A method has been proposed for the kinetic study of rapid endothermic reactions at high temperatures in a turbulent reactor, using tracer atoms. The method simplifies the mathematical treatment of results and allows one to obtain the kinetic characteristics (activation energy, rate constants) of the over-all process, as well as of its elementary stages, in a single series of runs.

36. New Isotopes of Erbium and Holmium

"New Isotopes of Erbium and Holmium," by I. S. Dneprovskiy; Moscow, Atomnaya Energiya, Vol 8, No 1, Jan 60, pp 46-47

The conversion electron spectra of the isotopes of the erbium fraction were investigated which form on bombardment of tantalum with protons having an energy of 660 Mev. The bombardment was carried out on the synchrocyclotron of the Joint Institute of Nuclear Research. Among the great number of conversion lines (more than 100) related to the neutron-deficient isotopes of erbium and holmium, a group of lines with a half-life of 2.4 hours was detected. Holmium was isolated from the erbium fraction. The existence of the decay chain $Er \xrightarrow{2.4\ \text{hours}} Ho \xrightarrow{27\ \text{minutes}} Dy$ was established on the basis of the experimental data obtained.

37. Identification of Ho^{155}

"The Neutron-Deficient Isotope Ho^{155}," by B. Dalkhsuren, I. Yu. Levenberg, Yu. V. Norseyev, V. N. Pokrovskiy, and S. S. Khaynatskiy; Moscow, Atomnaya Energiya, Vol 8, No 3, Mar 60, p 248

The existence of a holmium isotope with the mass number 155 and a half-life of 46 ± 3 minutes was definitely established. Its daughter element Dy^{155} was isolated.

38. Determination of Granular Materials by the Method of Neutron Deceleration

"Determination of the Water Content of Granular Materials by the Method of Neutron Deceleration," by A. K. Val'ter and M. L. Gol'din; Moscow, Atomnaya Energiya, Vol 8, No 3, Mar 60, pp 248-250

A method is described whereby the content of moisture in granular materials is determined by measuring the deceleration of neutrons passed through the material. A polonium-beryllium source of fast neutrons is used which contains one Curie of Po^{210} emitting 2.5×10^6 neutrons per second. The flux of neutrons which have passed through the moist material and have been decelerated by the water in it is recorded by a scintilator detector.

39. Use of Tritium for the Investigation of the Dynamics of Flow of Subterranean Waters

"Application of the Radioactive Isotope Tritium for the Investigation of the Dynamics of Subterranean Waters," by A. A. Abdullayev, Ye. M. Lobanov, B. K. Khaitov, and A. A. Khaydarov, Institute of Nuclear Physics, Academy of Sciences Uzbek SSR; Tashkent, Izvestiya Akademii Nauk UzSSR - Seriya Fiziko-Matematicheskikh Nauk, No 6, Nov/Dec 59 (published in Jan 60), pp 82-83

I-131, Na-24, Rb-86, Ru-103, Ir-192, Sb-124, Cr-51, and tritium have been used as radioactive tracers in the investigation of the dynamics of flow of subterranean waters, particularly in petroleum geology and in connection with the exploitation of petroleum wells. Among these tracers, tritium is of particular advantage for the application in question. The use of tritium in the study of subterranean waters by a method involving

application of internally filled Geiger-Mueller counters has the following advantages, as compared with other methods: (1) because tritium water has the same physico-chemical properties as ordinary water, no errors due to adsorption occur; (2) because of the long half-life of tritium (12.4 yr), tests can be carried out with greater precision as far as the effects of the decay of the radioactive tracer are concerned; and (3) the low energy of the beta-radiation emitted by tritium (0.019 mev) makes this isotope safe in use.

Procedures for field testing with the use of tritium are described.

III. EARTH SCIENCES

40. New Method of Geophysical Prospecting Tested in USSR

"The Interior of the Earth Reveals Secrets," by V. Novlyankin; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 15 Apr 60, p 1

Specialists of the Scientific Research Institute of Geophysical Methods of Prospecting have built an inexpensive, portable apparatus for determining the precise coordinates of anomalies discovered from the air.

The apparatus is capable of determining the coordinates of anomalies with an error of only 30-50 meters, according to Lenin Prize winner A. Lozinskaya, chief of the radiogeophysical laboratory, which makes it possible to develop extremely accurate geological maps.

The apparatus consists of several portable ground transmitters, 50-80 watts power, and a special receiver installed in an airplane. The transmitters are established at points, the coordinates of which are precisely known. They continuously transmit signals which are recorded by instruments installed in a moving object. These are three airplane-type receivers, electronic devices, which automatically determine the change in the distance between the airplane and the ground radio stations and the recording instrument.

The new method has already been tried in Yakutsk and in the Caspian, in particular in improving the coordinates of oil derricks. The greatest value of the new method is seen in the sinking of new wells.

According to Lozinskaya, in 1960 the new method will be applied also during aerogeophysical prospecting in Yakutsk, Obskaya guba, and in the Aral Sea.

IV. ELECTRONICS

Communications

41. Basic Noise Groups in Amplification Channels Determined

"Nonlinear Noises in the Linear Channel of a Coaxial Cable During Simultaneous Transmission of Telephone and Television Signals," by A. K. Oksman; Moscow, Elektrosvyaz', No 3, Mar 60, pp 34-43

The present work is concerned with the study of fundamental noise groups which determine the requirements for permissible nonlinearity of channel amplifiers.

The author examines nonlinear noises which occur as a result of the interaction of the synchronization and image components of a video signal in a television channel and those nonlinear noises occurring as a result of the interaction of telephone and television signals.

It is found that, of the many types of nonlinear noises, only several need be considered in determining the permissible nonlinearity of amplifiers. In a television channel, half or more of the power of random noise tolerance may lead to fluctuating channel noises, and they, for the most part, determine the transmission level of the television channel. The presence of inter-related noises $f_\ell \pm f_{teleph}$, $f_\ell \pm f_{1teleph} \pm f_{2teleph}$ necessitates an increase in the television transmission level by 0.2 - 0.3 henrys in comparison with the level determined by fluctuating channel noises.

In those telephone channels which are acted upon by second-order difference frequency noises (nf_s) from a television signal, these noises are the most substantial, and the telephone transmission level is, therefore, determined mostly by the magnitude of these noises.

42. Antifading Code

"Coding Immune to Fading," By E. L. Blokh and A. A. Kharkevich; Moscow, Elektrosvyaz', No 4, Apr 60, pp 3-6

The Principle of building noise-immune codes consists in selecting code combinations which differ among themselves by a sufficiently large number of symbols. If a certain number of symbols in such a combination are replaced by incorrect ones due to interference, then the remaining symbols will still permit correct identification of the transmitted combination.

The authors suggest a noise-immune uniform code system in which the message is composed of combinations with n-number of symbols. If a group of N-number of such combinations are represented in the form of a table so that each code combination occupies one vertical column and if the duration of complete transmission of each group is larger than the mean duration of a fading period, then each code group will be immune to fading.

The essence of the suggested noise-immune coding system can be better illustrated by analogy with facsimile transmission which is known to be fairly immune to interferences. The noise-immunity of facsimile transmission is due to the fact that each letter is transmitted, not as a single pulse, but by a series of narrow "cross-sections" offset in time, so that even if a few of the scanning lines are missing from the letter, the remaining portion of the letter outline is sufficient to identify it correctly.

43. Recent Soviet Patents in the Field of Communications

"Authorship Certificates" (unsigned article); Moscow, Elektrosvyaz', No 4, Apr 60, pp 75

Class $21a^1$, 7_{05}, No 123562, G. A. Yemel'yanov. A Method of Preventive Control of Telephone Channel Performance.

Class $21a^1$, 9_{01}. No 123995. Yu. A. Leybman and P. V. Mel'nikov. Device for Automatic Control of Start-Stop Telephone Signal Distortions.

Class $21a^1$, 11_{02}. No 122762. Yu. I. Savitskiy, I. A. Zdasyuk, and A. Ya. Ogoshkin. Decoder for Telegraph Apparatus.

Class $21a^1$, 32_{01}, No 122763. P. N. Ivanov. Adapter to Receiving Telegraph-Facsimile Apparatus for Recording Multicolor Images With Ink or Paints on Common Paper.

Class $21a^1$, 32_{11}. No 123998. V. A. Vatsenko, V. G. Patrunov, and V. P. Traubenberg. A Method for Automatic Setting of a Reproducing Head on a Recording Track in Receiving Facsimile-Telegraph Apparatus.

Class $21a^1$, 32_{35}. No 122764. V. A. Garsham, V. N. Vlasov, and N. Ye. Kirillov. A Method for Transmitting Stationary (Still) Black-and-White Outline Images.

Class $21a^1$, 32_{35}, No 124000. I. K. Malakhov-Kamartan. A Method for Improving Parameters of Transmitting Television Tubes by Utilizing the Change in Resistance of the Storage Layer Under the Action of Light.

Class $21a^1$, 34_{22}, No 122765. T. A. Byalkovskaya. A Method for Regulating the Signal Level and Image Contrast in Low Frame-Frequency Television Systems With Scanning Beam.

Class $21a^1$, 34_{31}. No 122766. M. N. Tovbin and I. F. Pes'yatskiy. A Method for Forming and Reproducing the Blue Signal in a Separate Color Image.

Class $21a^1$, 34_{31}. No 123564. I. Ya. Butlitskiy and R. Ye. Bykov. A Method of Transmitting Color Movie Films in Simultaneous Systems of Color Television.

Class $21a^1$, 34_{31}. No 124002. V. L. Kreytser. Simultaneous-Sequential System of Color Television.

Class $21a^1$, 36. No 122768. Yu. A. Leybman. Square-Pulse Generator.

Class $21a^1$, 36. No 122770. P. P. Fomin and Yu. A. Peschanskiy. Device for Two-Reading Measurement of Time Intervals and Their Conversion Into Digital Code.

Class $21a^1$, 36. No 123566. B. Ye. Bobrin and V. F. Razumovskiy. Device for Conversion of Pulse Sequences.

Class $21a^1$, 36. No 123568. L. A. Okovantsev and A. F. Petrov. Decade Reversing Counter Built With Junction Transistors.

Class $21a^1$, 36. No 124003. V. I. Shchitnikov. A Method of Pulse-Repetition-Rate Division.

Class $21a^1$, 36. No 124004. A Ya. Rotshteyn. A Method of Frequency Multiplication.

Class $21a^2$, 18_{08}. No 122775. I. K. Khrapko and R. I. Khrapko. Pulse Amplifier.

44. Need for Curriculum Revision of Radio Engineering Colleges

"Radio Engineering Disciplines," by M. S. Neyman, Moscow Aviation Institute imeni S. Ordzhonikidze, Kiev; Moscow, Izvestiya Vysshikh Uchebnykh Zavedeniy, Radiotekhnika, No 5, Sep/Oct 59, pp 624-628

The Article contains the following passages:

"The curriculum for training of radio engineers now lags considerably behind the present state of radio electronics. Certain important disciplines, which were formulated rather recently and have already acquired or are just beginning to acquire fundamental significance for the whole field of radio electronics, are not represented at all or are represented insufficiently in the curriculum. At the same time, the curricula are hampered by the multiplicity of subjects and are highly overburdened with many traditional courses which could either be combined or eliminated altogether.

"The principal cause for this situation can be traced to the fact that the radio engineering faculties were historically separated from the electrical engineering faculties, which in turn were earlier separated from the mechanical engineering faculties. The congealed traces of this historical process are still observable in the course selection for radio engineer training.

"The second cause for the situation is the rate of advancement of radio electronics, both in its direct engineering application and in the field of the associated basic sciences.

"At the present time, the curricula are so far behind the recent advances in radio electronics that they can not be radically corrected by the mere addition of new disciplines and will require considerably greater changes, affecting the whole structure of the curriculum."

Components

45. Automatic Amplitude-Stabilized Oscillators

"Amplitude Stabilized Oscillators With Automatic Amplification Control," by A. A. L'vovich; Moscow, Radiotekhnika, No 4, Apr 60, pp 54-62

Self-oscillators and synchronized oscillators with thermistor stabilizers are often used in multiplex communication systems and in metering circuits. The amplitude of the high-frequency voltage can be

stabilized with the aid of a device in which the source of high-frequency oscillations is not stabilized at the source; but the amplitude of output voltage is compared with a constant reference voltage with the aid of nonlinear devices (diodes or triodes) and subsequently regulated. Deviation of voltage amplitude from the nominal values brings into action a system of automatic control, which is based on interaction of controlled voltage with the transconductance of tubes in the high-voltage circuit.

The article discusses certain characteristics of amplitude stability of high-frequency, low-power tube self-oscillators and oscillators with independent excitation in which the amplitude of output voltage is stabilized by comparison with a stable constant voltage. The stable reference voltage can be secured from standard cadmium cells or from other sources of steady voltage.

46. Multielement Directional Couplers

"Wide-Band Wave-Guide Directional Couplers," by B. M. Mashkovtsev, L. Z. Bensman, and A. A. Khokhrev; Moscow, Radiotekhnika, No 4, Apr 60, pp 8-17

The wave-guide directional couplers known at the present time limit the reflectometer range to 10%. The article discusses the parameter requirements of a directional coupler at which the required precision of measurements of the coefficient of reflection of incident and reflected waves is readily attained. A method of calculation and a subsequent experimental investigation of a directional coupler having parameters within the allowable ranges of the frequency band are described.

A single directional element does not provide high directivity and uniformity of transient attenuation in a wide-frequency range at the present stage of wave-guide development. However, it is possible to build a wide-band directional coupler utilizing a combination of elements. Such a multielement directional coupler can be built with the utilization of nondirectional or directional coupling elements. A design for wideband coupling using nondirectional elements was described by B. F. Yemel'yanov.

The author presents a synthesis method for a multielement coupler, approximating the directivity function with the aid of a Chebyshev polynomial. A directional coupler with 20 elements has a directivity of 20 db in a wave-range of 2.9 to 3.65 cm, i.e., in 23% of the band. The transient attenuation within this band changes but slightly.

47. Electronic Model for Solving Two Systems of Equations

"On the Design of Electronic Mathematical Models for Solving Systems of Two Algebraic or Transcendental Equations by the Method of Root Selection," by A. N. Lebedev, Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin); Leningrad, Izvestiya Vysshikh Uchebnykh Zavedeniy -- Priborostroyeniye, Vol II, No 5, 1959, pp 72-79

"Fundamental recommendations are made for designing an electronic mathematical model for solving a system of two algebraic or transcendental equations

$$\varepsilon_1 = \Phi_1(Z_1, Z_2, X_i) = 0$$

$$\varepsilon_2 = \Phi_2(Z_1, Z_2, X_i) = 0$$

$$i_2 = 1,2 \ldots n$$

by the method of selecting unique and real roots $Z_1 = Z_1(X)$ and $Z_2 = Z_2(X_i)$, the object being to obtain optimum conditions of stability."

"In the most general case, a model for solving the above system contains a computer for reproducing the functions Φ_1, Φ_2 and two feedback lines consisting of amplifiers and sensing and actuating elements." Two variations of this model are examined, and conditions of stability for each are studied.

48. Method of Quadratic Approximation Proposed for Functional Generators

"Universal Functional Generator Based on the Principle of Quadratic Approximation," by A. A. Maslov and Yu. G. Purlov; Moscow, Avtomatika i Telemekhanika, No 2, Feb 60, pp 237-244

A method of quadratic approximation is proposed in the case of analytical and graphical definition of a function. Simple formulas and relationships are derived for finding the law of distribution of an argument. A variation of a diode element used for obtaining the quadratic relationship is examined.

The authors described the circuit of a universal functional generator based on quadratic approximation which is designed as an attachment for the type EMU-8 modeling device.

Among the advantages of a functional generator with quadratic approximation in comparison with generators using piecewise-linear approximation are a simplified circuit, a decrease in the number of tubes, and ease in setting-up the function and tuning the generator. The functional generator permits smooth reproduction of the function and eliminates discontinuities in the first derivative.

Disadvantages are the small passband of the apparatus (no greater than one kc) and the need for careful screening due to the high-frequency components of sawtooth voltage.

49. Determination of Reliability Criteria for Automatic Relays

"Reliability Criteria for Automatic Relay Devices With Radioactive Emitters," by A. G. Vasil'yev, I. S. Zhitomirskiy, and K. S. Klempner; Moscow, Avtomatika i Telemenkhanika, No 2, Feb 60, pp 245-253

"This work refines the limits of applicability of the first approximation made by the authors ("On Computing the Reliability of Automatic Gamma-Relay Devices," Avtomatika i Telemekhanika, Vol XX, No 2, 1959) for different values of relay parameters. Methods are given for a numerical computation of reliability with the desired degree of accuracy. Reliability according to the probability of "false" relay operations is determined, and methods are given for computing the average number of "false" operations per unit of time with any degree of accuracy. Graphs are provided for determining the probability of relay stay in a "false" state and the number of "false" switches for different combinations of relay parameters."

50. High-Density Recording on Magnetic Drums

"High-Density Recording of Numerical Information on a Magnetic Drum," by A. N. Myamlin, V. Yu. Vershubskiy, and E. I. Naumov, Mathematics Institute Academy of Sciences USSR; Gor'kiy, Izvestiya Vysshikh Uchebnykh Zavedeniy, Radiofizika, No 6, 1960, pp 998-1004

At present, the limiting factors for increasing magnetic-drum recording density are the constructional difficulties in reducing the size of the recording head and of the clearance between the head and the magnetic coating of the drum. To obtain a recording density of 10 digits to a millimeter, the magnetic field of the recording head should be limited in width to less than 100 microns. The reduction of clearance can be achieved with a floating type magnetic recording head incorporating an automatic follow-up of the magnetic drum surface. Testing of the floating type recording head was carried out with a 600-mm drum (ferrite-varnish coating) and a 200-mm drum (nickel-cobalt coating). The linear velocity of the drum was 30 m per sec.

A number of oscillograms were taken which plainly demonstrated that a floating recording head with automatic follow-up of the magnetic drum surface eliminated the throbbing of the drum generally observed with the use of rigidly supported recording heads.

This investigation led to the conclusion that proper design of a small-size floating type recording head and automatic follow-up of the drum surface will permit increasing the density of numerical information up to 20 digits per millimeter.

51. Effective Device for Numerical-to-Electrical Conversion

"Transducer for Converting Numerical Values to Electrical," by A. K. Zavolokin; Moscow, Avtomatika i Telemekhanika, No 2, Feb 60, pp 260-265

A device for converting numerical values to proportional values of voltage or current is described. The converter is based on the principle of intermediate conversion of a number to time intervals. In each conversion cycle, a single counter produces two successive signals of such duration that the time required for a complete cycle remains constant, and the duration of one of the signals is proportional in magnitude to the input value. This signal is used to modulate a stabilized constant voltage or current. After smoothing the width-modulated voltage (current), an electrical equivalent of the numerical value is generated.

Certain general information related to the design of such converters is given, and their advantages are listed. Among these are the simplicity of the circuit, the lack of precision elements and components requiring precision tuning, the ease of assembling the converter using transistor or ferrite-transistor elements, and the lack of special requirements for stability of input pulse frequency or time required for a complete cycle.

52. Output of Oil Wells Automatically Recorded

"A System for Automatically Telemetering the Output of Oil Wells," by A. A. Abdullayev and I. A. Nabiyev; Moscow, Avtomatika i Telemekhanika, No 2, Feb 60, pp 266-270

The article describes a system designed in the Scientific Research and Design Institute "Neftekhimavtomat" for automatically telemetering the output of oil wells. The system is capable of automatically measuring oil and water output individually and transmitting the information to a central control desk where it is recorded on a special chart. The system is one of the basic types of automatic equipment developed jointly with the Institute of Automatics and Telemechanics of the Academy of Sciences USSR and the All-Union Scientific Research Petroleum Institute.

Basic components of the system are a control panel and the measuring apparatus. Each measuring tank of the measuring apparatus serves eight wells. The measuring unit is equipped with regulating valves with pneumatic diaphragm actuating mechanisms, a manometer, and a position indicator.

Instruments and Equipment

53. Portable Phase Meter Developed

"Small Single-Phase Ferrodynamic Class 1.5 Phase Meter," by P. P. Ornatskiy, M. A. Ogorelin, Ye. S. Polishchuk, and V. S. Gnatyuk; Leningrad, Izvestiya Vysshikh Uchebnykh Zavedeniy -- Priborostroyeniye, Vol II, No 5, 1959, pp 54-57

A description is given of the design and operation of a portable ferrodynamic phase meter, based on the principle of the magnetic circuit of a permanent-magnet ratiometer with an infinite measurement range.

The phase meter, developed jointly by the chair of measuring apparatus of the Kiev Order of Lenin Polytechnic Institute and the "Tochelektropribor" plant, has a power factor range of 0.5-1.0-0.5 and an error of no greater than 1.5% for changes in current from J_{nom} to $0.5J_{nom}$ with frequency oscillations of $\pm$ 2% and ambient temperatures of $\pm$ 10 C. The phase meter was demonstrated at the World Industrial Exposition in Brussels and at the All-Union Exposition of Economic Achievements of the USSR in Moscow.

54. Measurement of Ultralow-Frequency Current

"Measurement of Electrical Quantities at Ultralow Frequencies," by P. P. Ornatskiy and P. B. Usatin; Moscow, Priborostroyeniye, No 3, Mar 60, pp 7-10

Ultralow-frequency current, i.e., frequencies below 15 cps, has recently found the following applications: electromagnetic stirring of molten steel at a current frequency of about 1.0 cps; electric welding of heavy machine parts at a current frequency of about 10 cps; and testing of automatic control equipment at a current frequency range of 0.01 to 10 cps.

At the Kiev Polytechnic Institute, experiments were carried out with thermoelectric instruments for measuring ultralow-frequency current in the range of 0.5 cps. Such instruments proved to be quite accurate for certain restricted conditions. At the Laboratory of the Chair for Metering Devices, ultralow-frequency meters utilizing capacitive filters were developed under the guidance of V. I. Chervyakovoy and P. B. Usatin.

A totally new method for measuring ultralow-frequency current was suggested by R. R. Kharchenko which utilizes electro-mechanical filters. Still another solution for measuring ultralow-frequency current was developed at the Kiev Polytechnic Institute, which utilized two quadrature meters producing a current phase shift of 90°.

The type V-136 frequency meter with a measuring range of 0-2 cps is now being manufactured.

55. Electronic Programming Devices

"Capability of the Electronic Device RU5-01 (02)," by L. N. Lipatov; Moscow, Priborostroyeniye, No 2, Mar 60, pp 9-10

The programmed electronic control device RU5-01 is designed for position control of various parameters in accordance with a preassigned program and is intended for operation in conjunction with the EPP, EMP, and EPD type metering instruments. The programmed controlling device RU5-02 is designed for proportional or proportional-plus-floating control of various parameters and is also intended for operation with EPP, EMP, and EPD automatic metering devices. The programmed control device RU5-01 is composed of a follow-up system, bridge circuit, and positioning control unit. The program for the follow-up unit can be drawn in the form of a curve with pencil or india ink on a tape.

The static follow-up error in relation to the total scale width is about 0.5%, the maximum length of the program tape is 16 meters, the maximum duration of a programmed period is 500 hours, the width of the tape is 160 mm, and the width of the program band is 10 mm.

The RU5 device with follow-up system of the described arrangement is the first of its kind manufactured in the USSR on a mass scale. The shortcomings of the RU5 device are slowness of the follow-up system and low speed of the tape.

56. New Experimental Devices for Measuring Heavy Currents

"Measurement of Heavy Direct Currents With the Aid of Bismuth Resistors and Hall-EMF Pickups," by P. G. Nikitin, D. A. Bezukladnikov, and Yu. I. Yushmanov, Ural Electromechanical Institute of Railroad Transportation Engineers and the Ural Polytechnic Institute imeni S. M. Kirov; Leningrad, Izvestiya Vysshikh Uchebnykh Zavedeniy -- Priborostroyeniye, Vol 2, No 5, 1959, pp 26-31

The use of a "bismuth spiral" in making magnetic measurements (based on the Gauss effect) is complicated by two factors -- the brittleness of bismuth and the high dependence of the resistance of a bismuth spiral on temperature.

In investigations made by the authors, a method of galvanic plating of metallic bismuth in a deep groove of a textolite base was used to prepare mechanically strong bismuth resistors having a resistance of 8-10 ohms and an area of approximately 12 X 25 mm.

Two such spirals with identical resistance and similar temperature characteristics were used in an experimental model, with one spiral acting as the pickup and the other for compensation of temperature errors of the instrument. A simple four-arm unbalanced a-c bridge was used as the measuring circuit.

In laboratory tests, errors with the experimental model did not exceed $\pm$ 1.5%, while under plant conditions, errors were no greater than $\pm$ 2.5%.

Another current measuring apparatus tested was a Hall-emf pickup, consisting of a strip of mercury selenide (HgSe) with an area of 10 X 35 mm. The strips were supplied by the Leningrad Semiconductor Institute. Electrical characteristics of the pickup were: operating current $J \leq$ 45 ma; sensitivity $\approx$ 3-5 microvolts/oersted; and resistance $\sim$ 50 ohms. Preliminary tests were made in the Laboratory of Physics by Prof P. V. Gel'd (Ural Polytechnic Institute imeni S. M. Kirov). Errors in results of measurements did not exceed $\pm$ 2-2.5%.

57. Transit Time of Electrons

"Measurements of Transit Time of Electrons in Photomultipliers," by V. M. Gorbachev, L. D. Usenko, and N. A. Uvarov; Moscow, Pribory i Tekhnika Eksperimenta, No 1, Jan/Feb 60, pp 69-73

Data on measurements of electron transit time in photomultipliers of Soviet production are presented. The measurement of electron transit time in various photomultipliers was carried out by the method of "controlled electron flux" devised by the authors and by the known "spark" method. The obtained data may be represented by a semiempirical formula of the type: $t^{-1}_{FEU} = a \sqrt{V} + b$, where the parameters a and b depend on the dynode system of the electron photomultiplier. The accuracy of measurements is (4 to 5)·10^{-9}sec. Suggestions are given on application of the devised method to the study of pulse characteristics of photomultipliers.

58. Group Frequency Propagation

"Device IGV-3 for Measuring Group Propagation Time of Frequencies" (unsigned article); Moscow, Pribory i Tekhnika Eksperimenta, No 1, Jan/Feb 60, p 153

The device IGV-3 is designed for measuring the group propagation time of frequencies of communication channels and quadripoles with lumped constants in a range of 0.3 to 10 Mc. The basic function of the device is the measurement of the characteristic of group propagation time of frequencies of wide-band channels without the use of an auxiliary feedback channel. The measurement of the group propagation time of frequencies is reduced to the measurement of the phase shift of the envelope of the amplitude-modulated oscillations between the input and output of the tested circuit.

59. New Amplifier

"Selective Measuring Amplifier IU-5" (unsigned article); Moscow, Pribory i Tekhnika Eksperimenta, No 1, Jan/Feb 60, p 150

The IU-5 amplifier is designed for amplification and frequency analysis of electric signals from a receiver in the ultrasonic frequency range or for measuring signal amplitudes in a narrow frequency band for elimination of interference signals on other frequencies. The amplifier has an operating range from 5 to 100 kc with continuous tuning. The

width of the transmission band of the amplifier is 1.3 kc. The amplification factor is 50,000 and may be attenuated stepwise by 10 db-80 db. The measured voltages are read on a pointer dial calibrated in decibels. The amplifier has two outputs; one designated for coupling to external measuring instruments and the second being an audio-frequency output for monitoring the converted signal with the aid of earphones.

60. Instrument for Statistical Study of Dynamic Characteristics

"Statistical Methods of Determining the Dynamic Characteristics of Industrial Objects in the Presence of Noise and an Analysis of Infra-Low Frequency Random Processes," by Yu. P. Leonov and L. N. Lipatov; Moscow, Avtomatika i Telemekhanika, No 2, Feb 60, pp 180-190

A description is given of an instrument used for the statistical study of the dynamic characteristics of objects in the presence of noises and for the analysis of infralow frequency random processes. The authors examine the possibility of using the instrument for computing correlation functions and dispersions, coefficients of a Fourier series, spectral density functions, frequency characteristics by statistical methods, and parameters of weight functions.

A block diagram and external view of the instrument are given, and the principles of operation of each component are described. The instrument records on a strip chart.

Maximum tracking speed of the instrument is 10 mm/sec, static tracking accuracy is 0.5%, and power consumption is 30 watts.

61. Photoelectric Instrument for Luminescence Determinations

"Photoelectric Instrument for Luminescence Determinations," by L. A. Shapunov, S. I. Krichmar, and E. G. Sumbayev, Dneprodzerzhinsk Nitrogen Fertilizer Plant; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 1, Jan 60, pp 182-183

A design of a photoelectric instrument for luminescence determinations has been proposed which employs a photoelectric multiplier, achieving a high sensitivity.

Materials

62. Silicon Photocell

"Energy Diagram of a Real Silicon Photocell," by V. K. Subashiyev and Ye. M. Pedyash, Institute of Semiconductors, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 2, No 2, Feb 60, pp 213-220

The study of silicon photocells has gained new importance because of their high efficiency as converters of solar energy. A method of plotting the energy diagram of a real photocell and its distribution of carrier concentration for equilibrium conditions are explained on the basis of experimental data obtained from measurements of the photocell and of the raw material. Parameters characterizing the operation of the photocell are also considered in the construction. As an example, diagrams of two silicon photocells obtained by diffusion of Sb into p-Si are presented. It follows from the obtained diagrams that the field and voltage drop in the diffusion layer should be taken into consideration in the functional analysis of such photocells.

63. Photosensitivity of Indium Antimonide

"Spectral Distribution of Photosensitivity in Indium Antimonide," by D. N. Nasledov, M. P. Pronina, and Yu. S. Smetannikova, Physicotechnical Institute, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 2, No 2, Feb 60, pp 239-241

The spectral characteristics of photoconductive and photomagnetic effects were measured on a number of samples of the p-type with acceptor concentration in the 10^{13} to 10^{15} cm^{-3} range. Monocrystalline samples of InSb were tested in the temperature range from 78 to 205° K. The measurements confirmed a linear variation of the width of the forbidden zone. With increasing temperature, the maximum of spectral sensitivity became more blurred, and near the temperature of solid carbon dioxide an additional maximum appeared at the edge of the photoconductivity curve.

64. Photoelectric Converters of Solar Energy

"Distribution of Losses and the Efficiency of Various Processes in Photoelectric Converters of Solar Energy," by V. K. Subashiyev, Institute of Semiconductors, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 2, No 2, Feb 60, pp 198-204

It is attempted to present a more complete analysis of processes essential to the functioning of a photoelectric converter of solar energy from the viewpoint of quantitative distribution of losses and the efficiency of separate processes. Theoretical results on photocells of Ge, Si, and CdTe, illuminated by a light corresponding to solar beyond the atmosphere, were tabulated. It was found that the efficiency cannot exceed 42% of the incident energy.

65. Germanium Testing

"Investigation of the Effect of Some Factors on Formation of Dislocations During Crystallization and Their State in Single Crystals of Germanium," by A. D. Belyayev, V. N. Vasilevskaya, and Ye. G. Miselyuk, Institute of Radio Engineering and Electronics, Academy of Sciences USSR, Moscow; Leningrad, Fizika Tverdogo Tela, Vol 2, No 2, Feb 60, pp 227-238

The effects on the formation and density of dislocations in single germanium crystals of the presence and density of dislocations in an etched crystal, the presence of impurities with concentrations exceeding the limits of their solubility during crystallization, and the rate of growth are studied. The effect of thermal treatment on the state of linear dislocations in the obtained material was also investigated. It was shown: (1) that dislocations distributed dispersely between boundaries of disoriented sections, upon high-temperature annealing ($t \geq 700 - 800$ °C), shift toward the boundaries of theses regions or of the crystal; (2) the disappearance of dislocations situated on boundaries of disoriented sections is observed at higher temperatures, near the melting point of germanium. Measurements were carried out to determine the effect of dislocation density from 10^3 to 10^7 cm^{-2} on the lifetime of single crystals of germanium.

"Influence of Processing of Germanium by Lead on the Lifetime of Unbalanced Charge Carriers," by A. K. Mednikov, Institute of Radio Engineering and Electronics, Moscow; Leningrad, Fizika Tverdogo Tela, Vol 2, No 2, Feb 60, pp 235-238

The possibility of eliminating Residual Cu from Ge by lead processing and the role played by residual chemical impurities and structural defects on recombination cross sections in Ge were studied. It was found that after elimination of residual amounts of Cu from Ge, the diffusion length of nonbasic charge carriers is strongly decreased; a subsequent increase of Cu concentration in the samples leads first to an increase of the diffusion length and thereafter to its decrease. The obtained results show that the presence of Cu admixture in the original centers decreases the cross sections of Ge recombination in agreement with F. D. Rossi's conclusion (RCA Review, 19, 349 (1958)).

"Investigation of Surface Electroconductivity of Germanium Single Crystals," by V. A. Presnov and V. F. Synorov, Siberian Physicotechnical Institute, Tomsk University imeni Kuybishev; Leningrad, Fizika Tverdogo Tela, Vol 2, No 3, Mar 60, pp 381-387

A study has been carried out of variation of conductivity of samples of monocrystalline germanium under the effect of various treatments and coatings.

"Powerful Germanium High-Frequency Triodes," by V. A. Struzhinskiy; Leningrad, Fizika Tverdogo Tela, Vol 2, No 3, Mar 60, pp 420-426

A new method is suggested for the construction of germanium triodes, based on phenomena of the behavior of copper in germanium. A powerful high frequency triode is devised which has, at 10 Mc frequency, an amplification coefficient of at least 10 db at an output power of 2 watt. Its basic parameters and characteristics are given.

"Nature of Volume-Gradient EMF Arising in Germanium With Current," by P. I. Baranskiy, Physics Institute, Academy of Sciences Ukrainian SSR, Kiev; Leningrad, Fizika Tverdogo Tela, Vol 2, No 3, Mar 60, pp 463-464

Experimental results led to the conclusion that the appearance of a volume-gradient emf depends on the effect of the distributed injection of nonbasic carriers arising in the germanium volume on gradients of specific resistance.

condary Electron Emission and Elastic Reflection of ectrons From Single Crystals of Germanium at Small ergies of Electrons," by A. R. Shulman and D. A. anishev, Leningrad Polytechnic Institute imeni Kalinin; eningrad, Fizika Tverdovo Tela, Vol 2, No 3, Mar 60, pp 530-536

The secondary emission of oriented germanium single crystals at an energy range of primary electrons from one to 50 ev is studied. It was found that secondary emission properties of single crystals differ from those of a germanium-coated film. The coefficient of elastic reflection from germanium single crystals increases within the range of one to 8 ev and has a maximum at 8 ev. In the range of 8 to 50 ev, a drop of the reflection coefficient is observed, its behavior having some peculiar points.

66. Conductivity of Glass

"Electroconductivity of Sodium-Aluminum-Silicate Glasses," by V. A. Ioffe and G. I. Khvostenko, Institute of the Chemistry of Silicates; Leningrad, Fizika Tverdogo Tela, Vol 2, No 3, Mar 60, pp 509-517

The electroconductivity of glasses of the system $Na_2O : xAl_2O_3 : (y - X)SiO_2$ at $y = 2$, 3, 4 and 6 and $x = 0$ to 1.1 in the temperature range from 15 to 240° C was studied. In the relationships $\log \sigma = f(\frac{1}{T})$ of glass with a ratio $\frac{Na_2O}{Al_2O_3} < 1$ and of nonalkaline calcium-aluminum-silicate glasses, there is a break; for the other glasses, this ratio is rectilinear within the temperature range of the experiments. The electroconductivity of the studied glasses depends on the ratio of the atomic content of aluminum to silicon in the glass. At increasing Al/Si, the electroconductivity rises, while the activation energy drops. With Al/Si increasing, the pre-exponential factor in the expression for electroconductivity also decreases. The assumption is expressed that the conductivity of sodium-aluminum-silicate glasses is of mixed ion-electron nature. With the ratio Al/Si increasing, the amount of electron conductivity rises, and the ion conductivity decreases.

67. Application of the Iodide Refining Method to Produce Semiconductor Silicon for Solar Cells and Ultrapure Silicon for Other Purposes

"Refining of Silicon by the Iodide Method," by A. A. Kuz'min and Ye. K. Safronov; Leningrad, Zhurnal Prikladnoy Khimii, Vol 33, No 3, Mar 60, pp 591-597

The optimum conditions have been determined for refining silicon by the iodide method. These conditions comprise a vapor pressure of silicon tetraiodide in the equipment equal to approximately 1.2 mm Hg (at a temperature of the equipment equal to 100°) and a temperature of the heated strip on which the silicon deposits equal to 1059°. The initial silicon which reacts with the iodine is kept at 400-500° by absorption of heat radiated from the heated strip. It was established that as a result of this type of refining, there is a thorough purification of the silicon from a number of admixtures such as iron, aluminum, calcium, and titanium. The method in question can be used to convert cheap silicon of the KR-0 grade to silicon which is suitable for application in solar cells. Furthermore, this method can be used in combination with other methods to produce ultrapure silicon. If ultrapure silicon is to be produced, then the silicon tetraiodide should be decomposed (and the refined silicon deposited) on a rod consisting of pure silicon.

The method described can also be used for the purification of other elements in the refining of which the necessary iodide vapor pressure is reached at a lower temperature than that needed for bringing about the reaction of iodine with the initial material.

68. USSR Work on Germanium in Coal

"Germanium in Coal," by V. I. Losev and T. S. Nikiforova; Leningrad, Zhurral Prikladnoy Khimii, Vol 33, No 3, Mar 60, pp 730-732

USSR work on germanium in coal is reviewed, with particular attention to research done by V. I. Losev and coworkers. It is pointed out that germanium is a dispersed rather than rare element. Experiments by Losev et.al. are described in which 30% of the total germanium contained in coal was extracted with water after the germanium has been converted into its tetrabromide by bromination of the coal. Subjecting the coal to the action of ultrasound during the bromination increases the degree of extraction of germanium to 80%.

To investigate the nature of the bond between germanium and organic substances in the coal, Losev and M. A. Troyanskaya, in work done at the Physical Chemistry Institute imeni Karpov, subjected coal to the action of gamma-radiation. It was established in the work in question that after coal of the PZh grade had been subjected to irradiation of an intensity of 200 roentgen-seconds in carbon tetrachloride, 53% of the germanium contained in the coal was extracted by the carbon tetrachloride. Irradiation of dry brown coal from the Moscow region in dry carbon tetrachloride resulted in an extraction by the carbon tetrachloride of 100% of the germanium contained in the coal.

It is concluded on the basis of the results described in the article that recovery of germanium from coal will increase the available supplies of this element, for which there is a great demand in the USSR at present.

69. Method for the Investigation of the Differential Thermal Electromotive Force at High Temperatures

"A Method for the Investigation of the Differential Thermal Electromotive Force at High Temperatures; The Principle of the Method," by V. S. Kutsev, B. F. Ormond, Yu. N. Chichikov, and R. N. Morzheyedova, Physical Chemistry Institute imeni L. Ya. Karpov; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 4, Apr 60, pp 891-893

Advancement of the theory of generation of thermal electromotive forces at high temperatures and the creation of materials for high-efficiency thermoelectric generators necessitate the development of a method for measuring thermal electromotive force factors at temperatures up to 2000°K. Hitherto, methods which can be applied only up to 1,500°K [1227°C] were available. A procedure has been devised for measuring thermal EMF values at temperatures up to 1,600°C and higher. This method is suitable for application in a higher temperature range because damage to platinumrhodium thermocouples is eliminated by introducing intermediate conductor rods between the substance being investigated and the contact points of the thermocouples. When high-melting nitrides are investigated, zironium nitride can be used as material for the intermediate conductors because zirconium nitride has the highest thermodynamic stability as far as decomposition with the evolution of nitrogen is concerned. One can also use high-melting metals, such as molybdenum or tungsten, which will not react with the nitride, taking nitrogen away from it. In a similar manner, a standard material which will serve as an intermediate conductor can be selected for high-melting silicides. The value measured by using an arrangement of this type will be the differential thermal EMF with reference to the standard material serving as the intermediate conductor. Knowledge of differential thermal EMF values at temperatures above 1200°C makes it possible to compare the thermoelectric properties of different materials at these temperatures.

Measurements were carried out on samples of tungsten carbide and silicon carbide using two variants of specially designed equipment in which graphite was employed as the intermediate conductor and standard material. Determinations at temperatures up to 1900°K were made in this equipment. Individual measurements were checked and regarded as correct when a graphite sample used in combination with the two graphite intermediate conductors yielded the result E = 0. It was thus shown that differential thermal EMF values can be measured at temperatures considerably greater than 1200°C. The temperature of 1600°C cannot be regarded as ultimate so far as application of this method is concerned. A detailed description of the equipment used and results of measurements made were published by the authors in Zhurnal Neorganicheskoy Khimii, Vol 5, No 1, Jan 60, pp 224-225.

70. Investigation Into the Temperature-Frequency Relationships of the Angle of Dielectric Losses of Mixed Polyesters

"Investigation Into the Temperature-Frequency Relationships of the Angle of Dielectric Losses of Mixed Polyesters," by G. P. Mikhailov and M. P. Eydelnant, Leningrad Polytechnic Institute imeni M. I. Kalinin; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, Feb 60, pp 295-302

The temperature-frequency relations of the angle of dielectric losses for a number of mixed polyesters of aromatic and aliphatic acids have been investigated.

Two regions of dipole-radical losses corresponding to the two acids and one region of dipole-elastic losses have been found for all the polyesters. The temperature of maximum tg δ of the dipole-elastic losses is determined by the concentration of the polyester component.

The capacity for crystallization of the mixed polyesters of which one component does not crystallize increases with an increase in concentration of the crystallizing component in the polyester. When the crystallizing component contains more aromatic nuclei than the non-crystallizing component, an increase in the degree of crystallinity may lead to a fall in the temperature of maximum tg δ of the dipole-elastic losses.

73. Fire-Jet Method of Rock Drilling

"Fire Drilling," by V. Rich and M. Chernenko; Moscow, Izobretatel' i Ratsionalizator, No 4, Apr 60, pp 25-27

The Dnepropetrovskiy Sovnarkhoz, which is in charge of the Kivoy Rog iron-ore basin (comprising hardest iron-quartzite ores), designed a fire-jet drilling apparatus in 1957. The Krivoy Rog Planning and Design Institute "Griprorudmash" also participated in the design of the first fire-jet drilling equipment, and in less than 6 months after the beginning of this work, A. V. Yagupov and his associates announced successful testing of the first industrial unit.

The drill "bit" consists of a water-cooled copper cylinder which acts as a combustion chamber. Burning of oxygen and kerosene in the chamber generates hot gases at a temperature close to 3,000°C. The hot gases ejected from the nozzle at a supersonic velocity impinge on the rock and cause it to spall and crumble.

This first unit was installed on one of the largest open pits of the Yuzhnyy Gornoobogatitel'nyy Kombinat (Southern Ore Dressing Combine). While the conventional methods of drilling require almost six changes of the bit in drilling one meter of hole, the fire-jet drill penetrates the hardest quartzite ore easily and without interruption. It was also shown that fire-jet drilling was about five times faster than the conventional. The Murmansk Sovnarkhoz is now testing its first fire-jet drilling equipment.

The author believes that the fire-jet drilling method has sufficiently proven its worthiness so that mass production of such equipment is justified at this time.

74. Double-Flow Hydraulic Turbines of 500,000-kw Capacity

"Radial-Axial Hydroturbines With a Twin Water Wheel," by M. M. Orakhelashvili; Moscow, Gidrotekhnicheskoye Stroitel'stvo, No 4, Apr 60, pp 11-14

The economical capacity of hydraulic turbines for the huge dams in the Eastern USSR is estimated at about 500,000 kw. The construction of turbines of such extraordinary size raises the following problems: reduction of the water-wheel size, especially its diameter; proper design of the spiral casing and reduction of its weight; increase of the turbine speed; and decrease of load on the main thrust bearing.

71. Polydimethylpolyphenylsiloxanes by Catalytic Condensation

"Polydimethylpolyphenylsiloxanes by Catalytic Condensation," by K. A. Andrianov and G. Ye. Golubkov, All-Union Electrical Engineering Institute imeni V. I. Lenin; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 2, Feb 60, pp 279-283

In the report, a description has been given of the mechanical, thermomechanical, and dielectric properties of products of the catalytic condensation of phenyltrichlorosilane and dimethyldichlorosilane. The polymers have been found to have no cross-linked structure. The addition of tetrafunctional monomers leads to cross-linking and to changed thermomechanical properties. Dielectric losses are due to a dipole-elastic mechanism.

72. Plastic Scintillators on a Polystyrene Basis

"Plastic Scintillators on a Polystyrene Basis -- Part 3" by Ye. Ye. Baroni, K. A. Kovyrzina, I. M. Rozman, Ye. Ye. Andreyeshchev, and V. M. Shoniya; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 3, Mar 60, pp 665-667

New organic additives have been described for the preparation of highly efficient plastic scintillators suitable for recording ionizing radiation.

[For additional information on materials, see Physics, Solid State Physics.]

The author suggests a hydraulic turbine with a twin water wheel in which the water from the spiral casing flows partly downward through the lower water wheel and partly upward through the upper water wheel. Each water wheel has its own draft tube. Such a twin-wheel turbine was designated RO-SVM 530 and is expected to generate 510,000 kw with a water head of 95 meters and runner speed of 136 rpm.

A twin-wheel turbine should have the following advantages over the conventional type of water turbines such as the one designed for the Krasnoyarsk Power Station: the diameter of the water wheel will be only 5.3 m in contrast to 7.5 m for a conventional turbine; the speed of the water wheel will be increased from 93.7 rpm to 136.4 4pm; the spiral casing will be decreased from 24 X 27.4 m to 22.4 X 24.3 m; the over-all weight of the turbine will be reduced about 15%; and the load on the main thrust bearing will be reduced by about 1,500 tons due to the upward thrust of the upper water wheel.

75. Extra-Long Electric Transmission Lines

"Problems of Efficiency of Extra-Long AC Transmission Lines," by V. K. Shcherbakov and O. V. Ol'shevskiy, Novosibirsk Electrical Engineering Institute; Minsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Energetika, No 2, Feb 60, pp 1-10

In connection with the recently observed accelerated process of amalgamation of individual power systems into larger systems serving huge territories of the USSR, the problem of designing transmission lines over 1,000 km long is becoming of great practical interest. Preliminary calculation for 2,000-km transmission line utilizing both series and shunt capacitors for power factor correction has shown rather poor transmission efficiencies for this type of reactive power control.

There exists a strong opinion among the experts in this field that for obtaining high efficiency, power lines longer than 1,000 km should be operated either with high-voltage dc current or with high-voltage ac lines tuned to half-wave. The advantages of the half-wave tuned power lines become more apparent as the length of transmission becomes greater.

An analysis of the efficiency of ac and dc extra-long power lines leads to the conclusion that in spite of certain economical advantages of high-voltage dc power transmission lines, this type of pwer transmission for extra-long distances is not the only practical method.

On the basis of economic factors, the half-wave tuned power lines closely approach dc power lines, and on the basis of some other considerations, they definitely possess certain advantages over dc lines; therefore, under certain conditions it becomes justifiable to select ac half-wave tuned power systems for the purpose of transmitting electric power to distances of about 2,000 km or greater. In most of these calculations, the line voltage was taken at 650 kv.

Differential Equations

76. Existence of Solution for Particular Integral Equation Proved

"Concerning One Nonlinear Integra Equation Having a Fixed Singularity," by T. A. Ebanoidze, Computer Center, Academy of Sciences Georgian SSR; Tbilisi, Soobshcheniya Akademii Nauk Gruzinskoy SSR, Vol 23, No 5, Nov 59, pp 521-526

A nonlinear integral equation having a fixed singularity of the form

$$\varphi(P) = \lambda \iint_S \frac{K(P, Q, \varphi(Q))}{r^2(Q, O)} \psi(\theta)\, ds_Q , \qquad (1)$$

is considered where s is a circle of unit radius with center at the origin of coordinates, P and Q are points of that circle, r and θ are polar coordinates of the point Q, $K(P, Q, \varphi)$ and $\psi(\theta)$ are given functions, $\varphi(P)$ is the function sought for, λ is a parameter, and the integral is taken in the sense of the principal value according to Cauchy.

In the present work, a theorem is proved for the existence of a solution for equation (1) when K, ψ and λ satisfy definite conditions.

Mathematical Machines

77. Methodical Errors of a Digital Differential Analyzer

"Concerning the Possibility of Correcting a Methodical Error of a Digital Differential Analyzer," by S. V. Misaylovskiy; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Energetika i Avtomatika, No 6, Sep/Oct 59, pp 156-161

The problem concerning the possibility of correcting a methodical error in the simplest individual functional integrator circuits for a digital differential analyzer in the case of a large required variation interval of the independent variable is considered.

The paper goes on to say that the fundamental element of the digital differential analyzer (TsDA) is the digital integrator.

It is assumed that the input and output quantities of the integrator are related by the expression

$$dz = ydx$$

the so-called characteristic equation of the TsDA. A circuit of these integrators provides an approximate solution to differential equations. A definite method of numerical integration is employed for obtaining the magnitude of an increment dz of the integral in the integrator. The TsDA is the simplest integrator according to stability in which the method of rectangles (Euler method) is employed.

In the paper, it is assumed that the TsDA is based on this method of numerical integration.

Stability and Control

78. Improvement of Dynamic Properties

"Concerning the Improvement of Dynamic Properties by a System of Extremal Control," by O. M. Kryzhanovskiy; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Energetika i Avtomatika, No 6, Nov/Dec 59, pp 151-155

Systems of extremal control are in effect one of the simplest optimum automatic self-adjusting systems and are finding even wider application for automatic determination of the optimum conditions for technological processes. For a thorough appraisal of extremal systems, it is necessary to investigate the quality of transient processes. In the case of insufficient quality of transient processes, it is necessary to modify the structural scheme of the extremal system in such a way that the dynamic properties of the system can be improved.

The following position is obtained upon limiting consideration to systems whose extremal characteristics have only one maximum while forming the differential equations for the transient processes. Let a system be found in a certain extremal position and let an abrupt jump modify the physical condition of the functioning of the object in such a way that the extremal characteristic receives a new position. Then transient processes from the old position of the extreme to the new position arise within the system. It will be assumed that the variation which occurred in the physical conditions was sufficiently insignificant that the dynamic system received "small perturbations." During investigation and synthesis of the system, it is necessary to consider that the magnitude of the extremum point coordinates is unknown in advance. The reading of the coordinates will be conducted from the new position of the extremum.

The transient processes arising within an extremal control system of smooth action are described, as a rule, by nonlinear differential equations. The author considers the class of those systems of extremal control in which the dynamics of the transient processes arising after perturbation of the extremal characteristic for the assumed conditions are described by the following differential equations:

$$DL(D)\mu = \alpha_1 u \qquad (1)$$

$$N(D)x = \alpha_2 \mu \qquad (2)$$

$$\varphi = -\alpha_3 x^2 \qquad (3)$$

$$M(D)y = \alpha_4 \qquad (4)$$

$$\text{and } u = \alpha_5 \frac{dy}{dx} \qquad (5)$$

where $D = \frac{d}{dt}$ signifies differentiation with respect to time, L(D), N(D), and M(D) are polynomials of D having constant coefficients, μ is the coordinate of the auxiliary motor, x is the coordinate of the object, where $x = 0$ is the new position of the maximum, φ is the coordinate of the extremal function, y is the coordinate of the measured value of the extremal function at the output of the object, u is the coordinate of the sensing element, and α_1, α_2, α_3, α_4, α_5, are constant coefficients.

79. Stability of Nonlinear Systems of Control Investigated

"Concerning the Region of Stability of Certain Nonlinear Systems of Control," by B. N. Skachkov; Leningrad, Vestnik Leningradskogo Universiteta, No 1, Jan 60, pp 100-103

The system of control

$$\begin{aligned} \dot{\eta} &= r\eta + n\xi, \\ \dot{\xi} &= f(\eta, \xi), \end{aligned} \qquad (1)$$

is considered where $f(\eta,\xi)$ is any continuous function of its arguments satisfying the conditions

$$f(\eta,\xi)\Big|_{\sigma=0} = 0$$

$$\sigma f(\eta,\xi)\Big|_{\sigma=0} > 0$$

Here $\sigma = p\eta - \xi$, and the numbers r, n, p are real constants, where

$$r < 0,$$

$n > 0$. The case when $n < 0$ reduces to the replacement of η by $-\eta$.

The system (1) may be considered as the system described for $n_1 = 0$ by the system of motion

$$\begin{aligned} \dot{\eta}_1 &= r_1 \eta_1 + n_1 \xi, \\ \dot{\eta}_2 &= r_2 \eta_2 + n_2 \xi, \\ \dot{\xi} &= f(\eta_1, \eta_2, \xi), \end{aligned} \tag{2}$$

lying on the plane $\eta_1 = 0$.

In the work by B. N. Skachkov, "Questions of Stability on the Whole and the Quality of Control for Several Systems of Differential Equations," Vestnik LGU, No 13, 1957, it was established that system (2) is stable on the whole if the condition

$$1 + \frac{|n_1 p_1|}{r_1} + \frac{|n_2 p_2|}{r_2} > 0 \tag{3}$$

is satisfied.

In the present work, the necessity of the inequality (3) for the stability on the whole of system (1) is proved.

Bacteriology

80. Effects of Formalin on Bacterial Toxins

"Certain Problems Connected With the Mechanism of Rendering Toxins Harmless With Formalin," by M. A. Torban, Stavropol Institute of Vaccines and Sera; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 4, Apr 60, pp 83-84

"In previous research, we had observed the aggregation of nitrogenous products of tetanus toxin during the process of its detoxication with formalin. The harmlessness of the toxin can be assessed on the basis of the intensity of accumulation of high-molecular products in the dynamics of anatoxin formation. Aggregation occurs more intensively when the concentration of formalin added is higher (up to 2%).

"The accumulation of high-molecular products precipitated by trichloracetic and phosphomolybdic acids also occurs during the transformation of diphtheria toxin into anatoxin; however, flocculation of molecules of the nitrogenous substances is less intense than in the process of rendering tetanus toxin harmless. This is a result of the significantly lower content of nitrogenous substances in Martenovskiy peptones in comparison with Gluzman peptones.

"The aggregation of peptones results not only from the action of formalin on natural toxin, but also from the addition of CH_2O to any peptone solution. The higher the concentration of peptone and formalin solutions and the higher the incubation temperature of these products, the more intense the accumulation of high-molecular nitrogenous substances. Incubation at 100° C permits observation of the aggregation of peptides within 2 hours.

"It was observed that high-molecular aggregates were formed by the interaction of formalin with β-alanine, lysine, cysteine, tyrosine, and histidine. The aggregation of lysine, norlysine, cysteine, and asparagin occurred less intensively; α-alanine, valine and β-phenylalanine did not enter into the aggregation reaction.

"Methylene bonds were formed between the amino acids mentioned above on treatment with formalin, as a result of which polymeric substances which could not be broken down by proteolytic enzymes, which did not coagulate on heating, and which fluoresced intensively were obtained. No biuret reaction was obtained with products of the aggregation of amino acids, but the biuret reaction of peptides treated with formalin was maintained without changes of the spectral characteristics.

"The above discussion permits us to suggest that the basic mechanism of rendering toxins harmless with formalin is the aggregation of nitrogenous products, at which time the bonding of toxophorous groups of toxin occurs. The products obtained as a result of this process are characterized by many polymers and by stability and chemical inertness, which also explains the resistance of anatoxins to heating, to prolonged preservation, and to the action of protease."

Contagious Diseases

81. Control of Encephalitis

"Committee for the Control of Tick-Borne Encephalitis," (unsigned article); Moscow, Meditsinskiy Rabotnik, Vol 23, No 37 (1889), 5 May 60, p 4

"A committee for the control of tick-borne encephalitis has been organized by the Ministry of Health RSFSR. The committee will coordinate scientific research and practical measures bearing on the problem of encephalitis. Members of the committee include: A. F. Serenko (chairman), Deputy Minister of Health RSFSR; Professors M. P. Chumakov, P. A. Petrishcheva, V. N. Beklemishev, Ye. N. Levkovich, and S. N. Pokrovskiy; and other scientists and practical workers."

Epidemiology

82. Etiology of Dysentery

"Water as a source of an Outbreak of a Toxicoinfection With a Dysentery Etiology," by M. G. Kolomiytseva and L. L. Nagnibeda, Khar'kov Municipal Sanitary-Epidemiological Station; Moscow, Gigiyena i Sanitariya, Vol 25, No 3, Mar 60, pp 102-104

The authors call attention to the fact that despite general opinion to the contrary, dysentery toxicoinfections can be caused by polluted water. They cite as an example the outbreak of dysentery toxicoinfections in Khar'kov in 1956. Investigations which were conducted established that the source of the infection were waters which either came from broken pipelines, or from pipelines which were laid without regard for sanitation rules. Greater sanitary and technical control of water systems is urged.

Hematology

83. Case of Transition of Leukosis Into Reticulosarcomatosis Following Antileukemic Treatment

"The Question of the Transition of Chronic Myeloleukosis Into Reticulosarcomatosis," by T. A. Belolipetskaya and I. I. Gets, Therapeutic and Pathological Anatomy Departments, Tulskaya Oblast Hospital; Moscow, Arkhiv Patologii, Vol 22, No 3, Mar 60, pp 61-64

In this report the authors describe a case of a 22-year-old patient suffering from chronic myelo- or lympho-leukosis who was subjected to prolonged X-ray treatment, following which the myelosis led to reticulosis (reticulosarcomatosis) with a lethal outcome.

The authors present the following conclusions: (1) It is possible to observe cases of the transition of chronic leukosis into reticulosis after prolonged antileukemic therapy. (2) The special form of leukosis which arises following this method of therapy is distinguished by certain clinico-anatomic characteristics. (3) Recent data on the blastomogenic effect of antileukemic therapy proves the need for extreme care in selecting the method of treating chronic leukosis.

84. Two Cases of Transitional Forms of Leukosis Described

"Concerning the Pathological Anatomy of Transitional Forms of Leukosis," by N. Ye. Yarygin, Chair of Pathological Anatomy, Yaroslavl' Medical Institute; Moscow, Arkhiv Patologii, Vol 22, No 3, Mar 60, pp 54-61

Recently published articles report that transitional forms of leukosis are sometimes encountered in addition to the usual forms. In this report, the author presents the clinicoanatomic description of the transition of chronic myelosis into systemic reticulosis in a 53-year-old patient, and of chronic lymphadenosis into reticulosis and reticulosarcomatosis in the second patient, 63 years old.

A thorough study of the blood picture of these two cases affords a basis for assuming that chronic myelosis passes through the phase of hemocytoblastosis or myeloblastosis; while in the case of chronic lymphadenosis it passes through the phase of lymphoblastosis. In both cases, reticulosis possesses the features of lymphogranulomatosis.

The author theorizes that the the existence of transitional forms of the disease between various types of leukoses, and also between leukosis, lymphosarcomatosis, or reticulosarcomatosis indicates the common and genetic nature of all these processes. Furthermore, the author links the onset of the transitional forms of leukosis with radiation therapy since the first patient had received two X-ray treatments, and the second patient had received three X-ray and three radio-phosphorus treatments.

Immunology and Therapy

85. Types C and E Anti-Botulinus Sera Evaluated

"The Experimental Effectiveness of Concentrated Types C and E Anti-Botulinus Sera," by F. F. Rezepov, Kazan' Institute of Epidemiology and Hygiene; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 4, Apr 60, pp 87-93

On the basis of data published by Kravchenko, Shishulina, and Matveyev concerning the distribution of types C and E botulism pathogens in the USSR, the author undertook to study the prophylactic and therapeutic action of the corresponding antisera on guinea pigs under optimum conditions. The sera, prepared in 1952-1956, contained 15,000-20,000 AE per ml after concentration by the combined dialysis method.

Intoxication was effected by the introduction of dry toxin obtained from filtrates of 7-day cultures. Type C toxin was administered perorally, and type E, subcutaneously. The intensity of passive immunity, maintained for 7-10 days after one administration of serum, was found to depend on the dose of serum and the corresponding concentration of antitoxin in the blood.

In the studies of the therapeutic effectiveness of the sera, an explanation of its effectiveness in intoxication produced by different doses of toxin, and of the significance of the dose and method of administration was attempted.

In the studies of therapeutic effectiveness, the animals were intoxicated with one, 2, and 10 MLD of toxin; serum was then given intravenously and intramuscularly in doses of 1-1,000 AE. On the basis of subsequent observations, the author concludes the following:

"1. Concentrated anti-botulinus serum, types C and E, were found to have a clearly expressed preventive effect.

"2. The therapeutic action of types C and E serum, as well as types A and B, was manifested when they were administered early, at the very onset of the disease.

"3. The fundamental factor which determined the therapeutic action of the serum was the time of administration. The higher the dose of toxin used to produce the infection, the earlier the serum had to be given to be therapeutically effective.

"4. The most effective method of introducing the serum was the intravenous method. No advantage of large, intravenous doses of serum was noted. Large, intramuscular doses were more effective.

"5. Repeated injection of serum did not increase its effectiveness."

86. Antigenic Properties of Botulinus Toxins

"Determination of the Antigenic Properties of Botulinus Toxins and Anatoxins, Types A and B, With the Aid of the Ring Precipitation Test," by Z. A. Voronova; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 4, Apr 60, pp 94-99

The research discussed in this article was performed to eliminate some of the drawbacks of the flocculation and ring precipitation reactions for determining the antigenic properties of botulinus anatoxins. A serum which would regularly cause a rapid ring precipitation reaction with natural and concentrated anatoxins was sought. The basic assumption was that the antigenic substances which accumulate in the process of culture growth originate only from microbial cells and that therefore the sera obtained through immunization of animals with microbial cells should contain corresponding antibodies to these antigens. Ther sera used in the experiments were obtained from rabbits immunized with 15-hour cultures of types A and B Cl. botulinum. After three immunization cycles (each cycle consisted of three injections of 30, 30, and 60 billion microbial cells), the rabbit sera contained 50 - 200 AE/ml, agglutinated homologous strains, did not agglutinate microbial cells of strains used for preparing the anatoxins, and guaranteed rapid precipitation with culture liquid. The methodology of the ring precipitation reaction is given.

The antigenic properties of the anatoxins tested were determined by the following equation:

$$A = \frac{a}{b} B$$

in which A is the antigenic activity of the anatoxin being tested, a the dilution at which ring precipitation occurred, b dilution of standard anatoxin, and B the antigenic activity of the latter in fixing units determined by titration in mice.

The following equation can be used to express the antigenic activity of anatoxins in milliliters:

$$A = \frac{b}{a} B$$

Results of the experiments are discussed and tabulated. The following conclusions are given:

1. It is possible to determine the antigenic properties of types A and B botulinus toxins and anatoxins rapidly (within an hour) by the ring precipitation reaction with sera obtained by immunization of rabbits with young microbial cells of a heterologous strain.

2. In parallel testing on white mice by the Becker-Kraus-Levenshteyn method, 88% of 240 series of natural and 82% of 76 series of concentrated types A and B botulinus anatoxins gave completely corresponding results. For the remaining series, the discrepancy in comparison with the antitoxin fixation reaction consisted of 6-10%.

3. The ring precipitation reflects the antigenic properties of botulinus toxins and can serve as a method of selecting them for anatoxin preparation.

4. The degree of toxicity (in MLD) of types A and B botulinus toxins, determined by titration in white mice, is not always adequate for evaluating antigenic properties, especially in cases of toxin activation with pancreatin and calcium chloride.

5. The ring precipitation reaction with the methodology suggested is recommended for determining the antigenic properties of natural and concentrated types A and B toxins and anatoxins instead of titration in white mice.

87. Distribution of Anthrax Vaccine Traced With Radioactive Isotopes

"A Study of the Distribution of Anthrax Vaccine in the Organism by the Use of Radioactive Indicators," by M. M. Agababyan, Chair of Epizootiology, Yerevan Zooveterinary Institute; Yerevan, Izvestiya Akademii Nauk Armyanskoy SSR--Biologicheskiye Nauki, Vol 12, No 12, Dec 59, pp 63-71

This detailed study concerns research performed to determine the fate of the first and second Tsenkovskiy vaccines in the animal organism, originally reported in issue No 1, 1959, of this publication. In the later phases of the work, the method of tagging the microorganisms with radioactive

substances was used; the following factors were studied: (a) the dynamics of the distribution and accumulation of Tsenkovskiy vaccine tagged with radiosulfur in the normal organism; and (b) the dynamics of the distribution of tagged B. anthracis in the immunized organism.

Glycerine-peptone agar containing 5.5 microcuries per ml of culture medium was placed in test tubes and seeded with first and second Tsenkovskiy vaccines prepared in 1956 at the Kalyzhinskaya Biofabrika, After incubation, the vaccine was tested for purity, uniformity of growth, and spore formatio..

After processing the vaccine, two series of experiments were performed on rabbits. In the first series, one ml of first Tsenkovskiy vaccine with a radioactivity of 1.7 microcuries was introduced subcutaneously to six rabbits; after 8 days the second vaccine was administered to the same rabbits in a dose of 1.5 ml with a total activity of 1.95 microcuries. In the second series, six rabbits were given 0.5 ml of first Tsenkovskiy vaccine, and the same dose of the second vaccine after 8 days. Thirty days after vaccination, the animals were infected with a virulent culture of tagged B. anthracis (strain No 575), obtained from the Republican Veterinary Bacteriological Laboratory. The culture contained one billion microorganisms per ml with a radioactivity of 1.6 microcuries, and was administered subcutaneously.

The results of all experiments are shown in tables and discussed extensively in the text. The following are some of the conclusions given:

"After the subcutaneous introduction of tagged Tsenkovskiy vaccine to rabbits, a large amount of radioactivity in the blood was observed during the first 2 days; the amount slowly decreased on the next day and reached the minimum level on the 35th day. In control animals which had received only radiosulfur, blood activity diminished sooner, and the minimum quantity of indicator in the blood was observed 20 days after the introduction of the radioactive substance. High radioactivity was noted in the liver, spleen, and kidneys of the experimental animals; the radioactivity of these organs was only one fourth that in the control animals.

Low radioactivity was observed in all the organs examined at the conclusion of the experiment, i.e., on the 35th day; the distribution of radioactivity was almost uniform in all organs.

In the immunized animals, the radioactivity diminished rapidly following the subcutaneous introduction of tagged B. anthracis, and reached its minimum on the eighth day; in controls, the indicator remained twice as long.

On the eighth day after the introduction of tagged B. anthracis, a significant decrease in the radioactivity of the organs was noted in the immunized animals; this distribution of radioactivity was not uniform. On examination of the organs of animals sacrificed on the 16th day after the introduction of the indicator, the radiosulfur concentration was found to

be somewhat higher than in immunized animals. On the basis of the data obtained, it can be said that the immunized organism eliminates radioactive B. anthracis much more quickly than the nonimmunized organism.

88. Antibody Production in Experimental Tularemia

"The Effect of Pentoxyl on the Production of Antibodies (Agglutinins) in Experimental Tularemia," by B. Yu. Kalinin, Chair of Biochemistry, Odessa Institute imeni Pirogov; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 4, Apr 60, pp 131-132

"The effect of pentoxyl on the production of agglutinins after the subcutaneous immunization of rabbits with live tularemia vaccine was studied.

"In the first series of experiments, 20 rabbits were immunized four times at 6-day intervals, each time with 50 million microbial cells, which was 0.6 of the dose used for cutaneous vaccination; in the second series, 20 rabbits were immunized once with 4.2 billion microbial cells, which was 52 times the dose used for cutaneous vaccination. In each series, the rabbits were divided into two equal groups, a control group and an experimental group. From the first day of immunization, the experimental animals were given pentoxyl internally once a day in the amount of 50 mg per kg of body weight. In the first series, the rabbits received pentoxyl for 30 days, and in the second series, for 20 days. Blood was drawn from all animals and the agglutination reaction was performed with serum (by the usual method) before the beginning of immunization and after 15, 20, 25, 30, and 35 days in the first series, and after 10, 15, 20, 25, 30, 35, and 40 days in the second series. The leucocyte count and differential were determined simultaneously.

"In both series, a marked increase in antibody production (an increase in the agglutinin titer) was observed under the effect of pentoxyl. In the first series, the average agglutinin titer in the experimental animals doubled the average titer in the control group 15 and 20 days before the initiation of immunization, and was 1.6 times that of the controls 25 days after; in the second series, the titer increased by 1.8 times after 10 days, by 1.4 times after 15 days, and by 1.3 times after 20 days. The agglutinin titers in both experimental and control animals were equalized within one month.

"Concerning the blood picture, a significant increase in the number of monocytes (about double) was noted in the experimental animals during the first 2 weeks after the beginning of immunization; this was observed only from the third week in the control rabbits.

"The experiments performed permit us to conclude that the daily, prolonged introduction of pentoxyl perorally in a dose of 50 mg/kg can stimulate the production of agglutinins after the immunization of rabbits with live tularemia vaccine."

89. Anti-Influenza Horse Serum Increases Body Sensitivity

"The Sensitizing Activity of Anti-Influenza Horse Serum Administered Intranasally," by A. A. Kolchurina, Kazan' Institute of Epidemiology and Hygiene; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 4, Apr 60, pp 99-100

It was found through a comparative experimental study of the sensitizing effects of intranasally administered dry and liquid anti-influenza horse serum on white mice and guinea pigs that these sera increase the sensitivity of the animals to horse protein. An early solution to the question of limiting their use for therapeutic and prophylactic purposes in children and to the question of obtaining them from other animal species is urged.

90. Antitumor Immunity

"Certain Aspects of the Study of Specific Antitumor Immunity," by L. A. Zil'ber (Moscow); Moscow, Uspekhi Sovremennoy Biologii, Vol 49, No 1, Jan/Feb 60, pp 71-85

The author briefly reviews the literary data on the work done in the search for a method of developing antitumor immunity. He cites the many arguments for and against the possibility of the development of such immunity, and concludes by saying that there is little doubt that antitumor immunity does exist, and that it is conditioned by certain antigens which are not found in normal tissue. It is the task of the scientists to isolate and concentrate these antigens. As a result of this the clinicists will then be able to obtain a preparation which they can use for diagnostic purposes, as well as for the prophylaxis and therapy of tumors.

91. Precipitation of Insecticidal Powders

"Simple Method of Precipitation of Contact Insecticidal Powders for Entomological Investigation," by Z. Vostal and L. Stromp, Ceskoslov. Epidemiol. Microbiol., Imun. (Czechoslovakia), 1959, 4, 273-276 (from Meditsinskiy Referativnyy Zhurnal, Section 3, Vol 4, No 1, Jan 60, p 66, Abstract No 304)

"A simple method for the distribution of contact insecticidal powders into Petri dishes has been devised by the authors. The method is based on the principle of precipitation. A definite quantity of the powder is forced from below into a closed glass hood by air pressure; the powder precipitates, settling evenly to the bottom of the Petri dishes placed in the hood. The advantage of this method is in its simplicity and the small amount of space required for equipment. The method may be utilized in the laboratories of sanitary-epidemiological stations in which investigations of the organic content in contact powders are being conducted."

92. Bactericidal Action of Propolis

"On the Problem of the Bactericidal Action of the Extract of Propolis on Certain Pathogenic Microorganisms," by Z. Kh. Karimova, K. I. Sevast'yanova, K. A. Savina, and L. M. Veyner, Chair of Microbiology of the Kazan' Medical Institute and Laboratory of Pathophysiology of Kazan Scientific Research Veterinary Institute; Kazan', Kazanskiy Meditsinskiy Zhurnal, Vol 41, No 1, Jan/Feb 60, pp 71-73

The results of experiments conducted to determine the bactericidal properties of the extract of propolis are reported. The extract was prepared by boiling 100 grams of propolis in 100 milliliters of distilled water on a water bath for one hour; the final extract was then obtained by filtering the mass through a filter paper. Solutions of the extract in distilled water, in concentrations of 1:1, 1:5, 1:10, 1:50, and 1:100 were used in the experiments. Its bactericidal properties were tested on staphylococci, streptococii, dysentery, leptospira, and treponema microorganisms. The basic extract, that is, the concentration of 1:1, was found to be bactericidal in relation to all the microorganisms tested. Its action on the bacteria differed only in respect to the time it took to kill the microorganisms: leptospira were killed within 10 minutes; staphylococci within 30 minutes; and Flexner's and Sonne dysentery bacteria, within an hour. Of particular interest was the depressing effect of the extract in vitro on the tubercular bacillus. It also was found to possess fungicidal properties. Further study of the action of the preparation in vitro, in experiments on animals, as well as in clinical application is recommended.

93. Tetraethylammonium Bromide Properties

"Pharmacodynamic Properties of Tetraethylammonium Bromide," by Milan Bargar and Alojz Hasik, Acta Fac. Pharmac. Brunen. et Bratisl (Slovakia), 1958, 1, 81-93 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 6, 25 Mar 60, Abstract No 8628, by the author)

"It was found that the ganglioblocking properties of tetraethylammonium bromide (1) (experiments were carried out on the upper cervical ganglion of cats) are dissipated by $CaCl_2$. Ca prevents the inhibition of intestinal peristalsis induced by tetraethylammonium bromide, large doses of which intensify the tonus and peristalsis of the small intestine. Neuromuscular paralysis induced by tetraethylammonium bromide is not dissipated by Ca, but is weakened by K."

94. Effect of Reserpine on Respiratory Organs

"Concerning the Side-Effects of Reserpine on the Upper Respiratory Organs," by I. Ya. Yakovleva, Candidate of Medical Sciences, Chair of Ear, Throat, and Nose Diseases, Central Institute for Advanced Training of Physicians; Moscow, Vestnik Otorinolaringologii, Vol 22, No 2, Mar/Apr 60, pp 67-70

The widespread use of reserpine in medical practice prompted the investigation of the effect of the drug on the respiratory organs, an effect not widely studied to date. A group of patients suffering from hypertonia received reserpine and were kept under observation for some time. The group included a number of patients who had no symptoms of infections in the respiratory organs. On the 15th day after the beginning of reserpine therapy, 18 of the patients began to complain of respiratory disturbances: rhinoclesis, dryness in the pharynx, considerable sneezing, and other minor disturbances of these organs. The disturbances disappeared when the administration of the drug was halted.

95. Effect of Rare Earth Metal Dusts on Respiratory Organs

"Experimental Study of the Effect of Concentrates of Dusts From Ores of Rare Earth Metals on Respiratory Organs," by Candidate of Medical Sciences O. Ya. Mogilevskaya, Chair of Industrial Hygiene, First Moscow Medical Institute imeni I. M. Sechenov; Moscow, Gigiyena i Sanitariya, No 4, Apr 60, pp 30-35

This article discusses three series of experiments which were conducted on 26 white rats to determine the effect of intratracheally administered dust from concentrates of ores of rare earth metal (Mo, Be and Ti) on the

respiratory organs. It was found that within 5 months the dust of the beryllium concentrate produced diffused, proliferating, and specific dust foci in the lung tissue and miliary and submiliary nodules in the regional lymphatic glands of experimental animals.

The molybdenum concentrate produced a diffused, penetrating, and moderate fibrosis of the lung tissue. The regional lymphatic glands were affected within 7 months after exposure to the dust of the molybdenum concentrate.

The titanium concentrate had a weak fibrogenic action.

The mixed dust of ore concentrates, introduced intratracheally, was found to produce more pronounced lesions than did the main metal component.

96. Effect of Anesthetics and Analeptics on the Organism

"Investigation of Metabolic Indexes Under the Influence of Anesthetics and Analeptics," by Yu. M. Gefter, A. M. Alekseyeva, Ye. L. Glinka-Chernorutskaya, M. A. Dobrinskaya, A. V. Zakharova, and Ye. K. Chetverikova, Uch. Zap. 1-vo Leningr. Med. In-ta (Scientific Notes of the First Leningrad Medical Institute) 1959, 3,111-122 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 6, 25 Mar 60, Abstract No 8589, by M. Shpil'reyn)

"The effect of chloral hydrate (I); barbamil (II); and the analeptics cordiamin (III), caffeine (IV), and strychnine nitrate (V) on the organism was studied in male rats (240 - 310 grams in weight). (I) in doses of 400 milligrams per kilogram of body weight was administered to the animals which were divided into three groups. The animals were then killed as follows: (a) 1½ hours after the administration of the drug while still asleep; (b) 1½ hours after the last of ten daily administrations; and (c) on awakening after a single administration of the drug. An increase in the alkaline reserves of the body (76.6 percent by volume; control 59.7 percent by volume), an increase in the concentration of acetone bodies (beta-hydroxybutyric acid mainly), an accumulation of creatine phosphate and adenosine triphosphate in the muscles, and a decrease of the quantity of glycogen (about 2.5 times in the liver) and acetic acid in the liver and muscles was found in the first group.

When chloral hydrate was applied directly into the tissues at a temperature of 37 degrees, the above-mentioned changes did not occur. A tendency toward the restoration to a normal level of the substances was noted in the second group of animals. In the third group of animals, the alkaline reserve was 64.6 percent by volume, the glycogen concentration in the liver was one fourth what it had been, and the increase in the quantity of the acetone

bodies was expressed more sharply than in the first group; the quantity of creatine phosphate and adenosine triphosphate did not differ from that in the control animals. (II) was administered subcutaneously to the animals in doses of 100 - 140 milligrams per kilogram of body weight. The changes which were found were similar to those described above, but less sharply expressed. (III) and (IV) were administered subcutaneously in doses of 50 milligrams per kilogram of body weight; and (V), in doses of 0.65 milligram per kilogram of body weight. Insignificant fluctuations in the biochemical indexes were found."

97. Lydasa, New Antispasmodic

"Perspectives of the Application of Hyaluronidase in Obstetrics and Gynecology. Application of Lydasa, a New Soviet Preparation, With Other Spasmolytics in Cases of Rigidity and Spastic Condition of the Uterine Cervix," by I. N. Rembez, Lvov Scientific Research Institute for the Protection of Mothers and Children; Moscow, Akusherstvo i Ginekologiya, Vol 36, No 2, Mar/Apr 60, pp 54-58

Lydasa (a specially purified enzyme preparation containing hyaluronidase and obtained from the testes of cattle by M. D. Mashkovskiy; cited in Lekarstvennyye Sredstva, Moscow, 1957, pp 375-376) was administered with beneficial results to 100 pregnant women and to women in labor suffering from a rigid and spastic condition of the uterine cervix. Lydasa was found to be particularly effective when used in combination with other spasmolytics in cases of difficult parturiency; it rapidly dilates the mouth of the uterus and hastens parturition. It is contraindicated in cases suffering from the acute stage of inflammatory infiltration.

98. Antibiotic Mycerin and Its Application

"Mycerin in Neurosurgical Practice," by Prof. A. Shlykov; Moscow, Meditsinskiy Rabotnik, Vol 23, No 35 (1887), 29 Apr 60, p 3

Experimental and clinical tests of mycerin, an antibiotic developed at the Institute of Epidemiology and Microbiology imeni N. F. Gamaleya, established that it possesses high antibacterial action against many gram-positive and gram-negative pathogenic microbes. It was determined at the same time that it is also active against strains of staphylococci isolated from spinal fluid and suppurative cerebrocranial wounds; these strains are sensitive to penicillin and streptomycin. Despite the growing resistance of microbes to the action of antibiotics, the effectiveness of mycerin remains at a high level for long periods of time. It is slightly toxic and has no cumulative effect. Mycerin does not cause any side effects. Clinically, mycerin was found to be highly effective against postoperative suppurative complications and suppurative inflammations of the spinal cord and cerebrum.

99. Diasolin, New Antihistamine and Antianaphylactic Drug

"Diasolin" (unsigned article); Moscow, Meditsinskiy Rabotnik, Vol 23, No 35, (1887), 29 Apr 60, p 4

"Diasolin, an antihistamine and antianaphylactic preparation of prolonged action was synthesized at the Scientific Research Institute of Pharmacology and Chemotherapy of the Academy of Medical Sciences USSR. Experimental and clinical investigations have shown that diasolin, while being as active as dimedrol, has the advantage of prolonged action. The preparation is highly active against pruritus, and produces favorable results in cases in which dimedrol, novocaine, and bromine preparations are ineffective. Diasolin is effective also in the therapy of capillary toxicosis. The new preparation is readily tolerated by children and adults. Side effects are seldom noted; it does not depress the central nervous system and can be prescribed for use by out-patients. The dose of the preparation is 0.05 - 0.2 grams one or two times a day for adults, and 0.02 - 0.05 grams one to three times a day for children. The Pharmacological Committee of the Academy of Medical Sciences USSR issued a permit for the clinical use of diasolin."

100. Intoxicating Honey

"Case of Intoxication by 'Intoxicating' Honey," by V. M. Bauman and V. Sh. Shatayev; Moscow, Gigiyena i Sanitariya, Vol 35, No 3, Mar 60, pp 96-98

The article describes a number of cases of intoxications caused by honey. The symptoms in all cases, regardless of their severity, were asthenia, headaches, dizziness, nausea, vomiting, poor motor coordination, and spasms of the extremities. In severe cases, slight leukocytosis developed. The average duration of the intoxication was from 2 to 5 days. Investigations traced the honey to the Khabarovsk area where, because of occasional late springs, bees were forced to gather nectar from the flowers of bryophyta, heather, and wild rosemary. The nectar from the flowers of these plants contains poisonous substances.

Physiology

101. Effect of Hypoxia on Animal Organism

"Significance of the Inhibition of the Central Nervous System in Oxygen Insufficiency," by V. A. Konstantinov (Leningrad), Chair of Pathological Physiology, Military-Medical Order of Lenin Academy imeni S. M. Kirov; Patologicheskaya Fiziologiya i Eksperimental'naya Terapiya, Vol 4, No 2, Mar/Apr 60, pp 58-62

White mice were used in the experiments carried out to determine the reaction of the organism to oxygen insufficiencey. Hypoxia was induced in the animals by placing them in a hermetically sealed container having a volume of about 100 cubic meters. The external picture of asphyxia was normal: stimulated movement in the beginning followed by spasmodic attacks and the cessation of breathing. Control experiments established that if the animals were taken from the container 20-40 seconds before the cessation of air intakes, respiration was restored and the animals survived. This method made it possible to determine the threshold of the maximal time an animal could remain in the hermetically sealed container. The average maximal time was found to be 12-13 minutes. The inhibitory effect of hypoxia on the central nervous system was manifested in the behavior of the animals, which differed sharply from that of the intact animals. Within 24 hours, however, the mice became active again and did not differ from the other animals in their behavior.

Further experiments established that inhibition of the central nervous system produced by a single subjection of the animals to hypoxia becomes deeper and more pronounced when the animal is subjected to repeated experiments. This indicates that hypoxia has a cumulative effect on the nervous system.

102. Skin Reaction to Climatic Changes

"Vascular Skin Reaction in Response to Cooling in Connection With the Changes of the Microclimate and Macroclimate," by G. L. Khazan, L. D. Romanova, and V. F. Rudenko, Ukrainian Institute of Industrial Hygiene and Occupational Diseases; Moscow, Gigiyena i Sanitariya, No 4, Apr 60, pp 19-23

The authors of this article state that they used a cooling test to determine vascular skin reactions in 32 perople (11 men and 21 women), of which 18 were under 30 years of age and 14 were between 30 and 60

years of age. The study was conducted during September and October and lasted 3 weeks. One finger was cooled in water at 5°C for a period of one minute. The extent of the vascular reaction was assessed by the changes in the skin temperature before and after cooling.

Results obtained showed that the initial skin temperature and the rate of its rise after cooling depended both on the temperature of the air outside and on the temperature of the air inside the premises.

103. Cholinesterase Activity in Hepatic Diseases

"Cholinesterase of the Blood Serum in Hepatic Diseases," by M. P. Kuz'minykh, Therapeutic Division of the Republican Clinical Hospital, Tatarskaya ASSR; Kazan', Kazanskiy Meditsinskiy Zhurnal, Vol 41, No 1, pp 26-29

The article reports on the results of investigations conducted to determine the modifications which occur in the activity of cholinesterase in patients suffering from hepatic diseases. The observations established that: cholinesterase activity is considerably depressed in patients suffering from Botkin's disease, chronic dystrophy of the liver with a prolonged course of the disease, and cyrrhosis of the liver: in cases of cattarhal cholistitis, cholinesterase activity remains at a normal level; cholinesterase is sharply depressed in cases of Addison-Biermer disease; and cholinesterase activity can serve as an important index of the functional capacity of the liver.

104. Effect of Nervous Functions on Gastric Secretions

"Gastric Gland Functions in Certain Disturbances of the Central Nervous System," by V. M. Frolov, Chair of Normal Physiology, Military-Medical Order of Lenin Academy imeni S. M. Kirov; Moscow, Patologicheskaya Fiziologiya i Eksperimental'naya Terapiya, Vol 4, No 2, Mar/Apr 60, pp 62-65

Experiments conducted on dogs determined that the secretory functions of the gastric glands are controlled by the stimulatory or inhibitory actions of the cerebral cortex cells. Maximal normal secretions of the gastric juice take place when the cortical stimulatory and inhibitory factors are in equilibrium. When the equilibrium is disturbed by either the excitation or inhibition of the cortical cells of the brain, gastric secretion is either increased or inhibited. Hypnotic experiments revealed also that hypnotic phases of the cerebral cortex are paralleled by corresponding phases in the functions of the gastric glands.

105. Neurohumoral Sleep Theory

"Neurohormonal Factors in the Development of Sleep," by A. V. Tonkikh, Institue of Physiology imeni I. P. Pavlov, Academy of Sciences USSR; Moscow, Zhurnal Vysshey Nervnoy Deyatel'nosti, Vol 10, No 2, Mar/Apr 60, pp 285-290

The author of this article states that an associate of his laboratory, Yu, A. Borkovskaya, showed that the subcutaneous administration of adrenalin to cats (0.13 milligram to each cat weighing between 2.5 and 3 kilograms) produced a two-phase effect. The first phase consisted of excitation, which was manifested within 10-15 minutes after adrenalin was administered and lasted approximately one hour. The second phase consisted of drowsiness followed by profound sleep which lasted 4-6 hours. An EEG taken during the first phase revealed a slight acceleration in rhythm. The EEG taken during the second phase showed slow waves of high amplitude, both in the cortex and in the subcortical formations, especially 3 hours after adrenalin was administered. ACTH produced similar effects in cats.

The injection of adrenalin to cats which had been subjected to extirpation of the hypophysis affected neither their behavior nor their EEG pattern. A similar effect was produced by ACTH on hypophysectomized cats.

Data from this article were read at a session of the Leningrad Society of Physiologists, Biochemists, and Pharmacologists imeni I. M. Sechenov, held on 8 December 1959 on the anniversary of the death of L. A. Orbeli.

106. Apparatus for Embedding Electrodes in Dog Brain

"Stereotactic Device for Inserting Electrodes into a Dog's Brain," by A. Ya. Mogilevskiy, Central Clinical Psychoneurological and Neurosurgical Hospital, Ministry of Railways, USSR; Moscow, Zhurnal Vysshey Nervnoy Deyatel'nosti, Vol 10, No 2, Mar/Apr 60, pp 297-300

This article describes a stereotactic apparatus designed for use in experiments on subcortical nuclei of the brain stem of dogs, irrespective of the size and shape of the head. This stereotactic apparatus can be used also in experiments on cats and rabbits. The apparatus contains a mechanism which allows the insertion of electrodes at any angle. This is necessary in experiments on the bulbo-mesencephalic area. The possibilities of using a micromanipulator in embedding the electrode, and of using an electric drill connected to the electrode holder are being investigated; this facilitates trepanation of the cranium and reduces the danger of damage to the brain.

The apparatus described is comparatively simple and does not require parts which are difficult to obtain. A schematic diagram of the apparatus is given.

107. Method of Fixing Electrodes Described

"New Method of Fixing Electrodes, Checking Their Vertical Position and Determining the Zero Coordinate When Operating a Stereotactic Apparatus, "by R. M. Meshcherskiy, Laboratory of General Physiology of the Central Nervous System, Institute of Higher Nervous Activity, Academy of Sciences USSR; Moscow, Zhurnal Vysshey Nervnoy Deyatel'nosti, Vol 10, No 2, Mar/Apr 60, pp 301-304

According to this article, occasions arise in neurophysiological experiments when various types of electrodes must be used. Available electrodes have not been very useful in extended experiments. The STM-1 and STM-1A stereotactic devices were, therefore, developed at the Institute of Higher Nervous Activity of the Academy of Sciences USSR for rapid and accurate alignment of vertical electrodes. The STM-1A device is described in the text. It consists of a control stand which is firmly attached to the base in a vertical position. The part of the electrode which is to be embedded in the cranium is inserted into the alignment slit of the control stand. The electrode is fastened to the control stand by a rubber ring. A locator is installed into that part of an electrode which protrudes from the slit. This locator is fastened to the clamp of the electrode holder.

The index pin consists of a metal core covered with a thin layer of asbestos. Thin nichrome wire with a resistance of 20 ohms is wound over the asbestos. The lower part of the index pin, which comes into contact with the electrode, is covered with a one-mm layer of beeswax. When the current is transmitted through the nichrome winding, the wax melts. When the melting wax begins to envelop the tip of the electrode to which the current is fed, the current is cut off. The wax becomes hardened within a few seconds and fixes the electrode to the index pin.

Schematic diagrams of the STM-1A device are shown.

108. Leninist Basis of Higher Nervous Activity Theories

"The Effect of V. I. Lenin's Ideas on the Development of the Theory of Higher Nervous Activity," by P. Kupalov, A. Volokhov, and L. Voronin; Moscow, Zhurnal Vysshey Nervnoy Deyatel'nosti, Vol 10, No 2, Mar/Apr 60, pp 161-166

This article commemorates the 90th anniversary of the birth of V. I. Lenin. Lenin, they continue, has made a great contribution to Marxist philosophy; Leninism has exerted a great influence on all social phenomena, on the daily lives of many people, and on the development of all branches of science, including natural science. Marxist-Leninst ideas have also had great influence on the development of theories in the field of higher nervous activity.

Lenin's philosophical work Materialism and Empiriocriticism, published in 1909, is of special significance. In this book he strongly criticized the reactionary philosophy of empiriocriticism and summarized the progress that had been made in natural sciences. He also developed the dialectic-materialistic theory of knowledge. The philosophical explanation of matter and sensation, he wrote, plays an important role in the solution of the fundamental philosophical question of the relationship between the spirit and matter.

V. I. Lenin demonstrated the incompetence of those physiologists who defend the idealistic notion of the so-called law of specific energy in the function of the organs of sensation. I. P. Pavlov, who subsequently created the materialistic theory of analysors, also pointed out the scientific inadequacy of those physiologists who separate an organism from its conditions of existence and from its historical development in the process of which the analysors took form. I. P. Pavlov's teachings about analysors serve as a natural scientific basis for the Leninist theory of reflection.

Marxism-Leninism teaches that the influence of the objective reality of the outside world, bestowed on humans in the form of sensation which reflects this world, is the primary element of the perception of reality. This finds its reflection in the ideas which I. P. Pavlov reached in the course of his investigations of higher nervous activity. He evolved the first signal system in the activity of the brain. The first signal system is common both to humans and to animal life.

Results of investigations conducted later by I. P. Pavlov confirmed V. I. Lenin's hypotheses. In expounding his idea of the second signal system, Pavlov stated that: "The spoken word forms the second signal system, the signal system of reality...." He further stated that "If

our sensations and ideas, related to the immediate environment, are the first signals of reality, for us, the spoken word is the second signal, the signal of signals". Using the language of the physiology of higher nervous activity, I. P. Pavlov actually expressed the philosophical hypotheses of V. I. Lenin.

Pavlov's views concerning the relationship between signal systems of reality coincide with Leninist philosophical thoughts concerning the perception of the objective world. According to Lenin, the dialectic path of the perception of objective reality proceeds from vivid contemplation (the first signal system, according to Pavlov) to abstract thought (the second signal system of reality, according to Pavlov) and from there to the practical verification of the conclusions of abstract thought.

Thus, the second signal system makes it possible to have a correct sensation of reality only when the human being, while perceiving the truth, does not detach abstract thought from experience, and verifies the results of his thinking by practice. And this is the same dialectic path of the perception of truth which was pointed out by Lenin, except that it is expressed in physiological terms.

Ideas put forward by V. I. Lenin in his book Materialism and Empiriocriticism and other works exerted and are still exerting a great influence on the development of one of the most important branches of natural science: the physiology of higher nervous activity.

Recognizing the scientific importance of the new branch of learning, V. I. Lenin became an ardent admirer of I. P. Pavlov, the father of teachings concerning the physiology of higher nervous activity. The Soviet of People's Commissars issued a decree in January 1921 ordering that I. P. Pavlov and his associates be given all kinds of aid and privileges to facilitate continuation of their work. This decree was signed by V. I. Lenin. It helped Pavlov to expand his research in the physiology of higher nervous activity. The party and the government continued to help Pavlov in his research work. A number of institutes, laboratories, and chairs of higher nervous activity were organized in the USSR as a result. Publication of the periodical Zhurnal Vysshey Nervnoy Deyatel'nosti was eventually begun. This periodical has as its purposes the promotion of knowledge in the field of the physiology of higher nervous activity along the theoretical and practical lines drawn by Marxism and Leninism, the promotion of adherence to authentically scientific materialism, and the dissemination of scientific knowledge among the population.

In conclusion, this article says that special attention must be given to solving problems in the physiology of higher nervous activity which are connected with the building of a Communist society in the USSR, and

which are directed toward obliterating all existing inconsistencies between mental and physical work, toward the development of the hygiene of mental work, physical culture, and sports, toward the formulation of rational methods for the education and training of young people, toward the development of aviation and space medicine, and other branches of physiological science which are connected with human activity under special conditions.

Public Health, Hygiene, and Sanitation

109. Determination of Cyanides in Sewage Water

"On the Method of the Determination of Cyanides in the Waste Water of Coke-Chemical Plants and Gas-Generating Stations," by F. G. Detlovitskaya, Ukraine Institute of Public Hygiene; Moscow, Gigiyena i Sanitariya, Vol 25, No 2, Feb 60, pp 51-54

A method of the colorimetric determination of cyanides in the waste waters of coke-chemical and other plants has been proposed. By this method, the cyanides are distilled from a weak acid medium in the presence of lead nitrate; they are then converted into thiosulfides by heating them in a solution of sodium tetrathionate in an alkaline medium. The sensitivity of the method is equal to 0.5 milligram of CN per liter. The method is also applicable in the determination of the cyanide content in the waste waters of gas generating plants. The margin of error is 2-6 percent.

110. Problems of Technological Era

"Technological Progress and Problems of Labor Hygiene," by Prof Z. I. Izrael'son, Chair of Labor Hygiene, First Moscow Order of Lenin Medical Institute imeni I. M. Sevchenko; Moscow, Gigiyena i Sanitariya, Vol 25, No 2, 1960, pp 3-12

The technological developments of recent years have created a number of health problems which the First Moscow Order of Lenin Medical Institute imeni I. M. Sechenov must take an active part in solving. Investigations must be carried to learn the effect of ionizing radiation, electromagnetic fluctuations caused by high-frequency generators, vibrations, noise, and ultrasound waves on the organism. Little is yet known of the toxicology of monomers, intermediary products, and others. Studies must be made of the effect of the assembly-line system of production on the organism of the workers. It is known that this system induces monotony

and rapid fatigue as a result of the inhibiting action of monotonously repeated stimuli. Modern industry is utilizing a large number of new raw materials, including many new and rare metals, and metal alloys. The exceptional importance of these metals, the properties of which are not yet well known from a hygienic viewpoint, has prompted the Chair of Hygiene and Sanitation to launch a program of investigations to establish the effect of these materials on the health of the workers.

The problems to be studied are as follows: (1) working conditions in the process of refining and application of new and rare metals and metal alloys, and their effect on the organism; (2) the health of the workers working with these materials; and (3) development of hygienic norms and recommendations for the protection of the health of the workers of the enterprises where these materials are used. Such metals as molybdenum, zirconium, beryllium, titanium, nickel, vanadium, cadmium, cobalt, tungsten, tantalum, niobium, selenium, tellurium, and others have already been investigated. What is particularly important is that in many stages of their processing and application, a number of these metals produce aerosols which are disperseed in the air of the areas where the work is carried on. Investigations established that many of them are highly toxic, and almost all are able to produce chronic pathological processes. All have been found to have some pathological effect on the respiratory organs. Prophylaxis of these effects is the most important task which confronts the staff of the Chair of Hygiene and Sanitation of the institute. The country is going through a period of unprecedented industrial growth and technological development, therefore, medicine, particularly prophylactic medicine, and public health must keep in step with these developments.

111. 1960 Public Health Plan Discussed

"National Economic Plan for Public Health for 1960," by A. L. Dorosinskiy, chief of Planning and Finance Administration, Ministry of Health Belorussian SSR; Minsk, Zdravookhraneniye Belorussii, No 3, Mar 60, pp 3-4

This article states that much was accomplished during 1959, the first year of the Seven-Year Plan, both throughout the entire USSR and in every part of the Belorussian SSR. Increased production of consumer goods and expanded housing facilities have created favorable conditions for protection of the health of the population of Belorussia.

The capacity of hospitals in the Belorussian SSR increased by 2,980 beds during 1959. Consequently, there were 49,980 beds available by the end of the year, in hospitals under the jurisdiction of the Ministry of Health of the Belorussian SSR. If the bed capacity of

hospitals which are not under the jurisdiction of the Ministry of Health is added to this figure, the total number of hospital beds available to the population of the republic is 51,915. This amounts to 63.9 hospital beds per 10,000 people. The average number of hospital beds available per 10,000 people was greater in the majority of the union republics and in the USSR as a whole. Throughout the USSR, the ratio by the end of 1959 was 76.3 hospital beds per 10,000 people.

The plan for 1960 provides for increasing the capacity by 3,360 beds in all hospitals which are under the jurisdiction of the Ministry of Health Belorussian SSR; this is expected to increase the capacity of all such hospitals to 53,340 beds. If the bed capacity of hospitals which are under the jurisdiction of other departments is added, the total bed capacity of all hospitals of the republic is expected to reach 55,300 by the end of 1960. The ratio at that time will be 67 hospital beds per 10,000 people.

The number of nurseries in the Belorussian SSR has been increasing in the past few years and this trend is continuing. There were 22,300 spaces available in nurseries under the jurisdiction of all departments (excluding spaces available in nurseries which are under the jurisdiction of the Ministry of Railways) at the end of 1959. Almost 2,500 spaces were made available during 1959. Although the annual plan for 1960 specifies that 5,000 more nursery spaces must be made available by the end of the year, the number of such spaces will still be inadequate.

Medical institutes and medical schools of the Belorussian SSR graduated 696 physicians and 1,562 semiprofessional medical workers during 1959. In 1958, there were 12.5 physicians per 10,000 people in the republic; in 1959, there were 13.4 physicians per 10,000 people. These figures include all physicians under the jurisdiction of all departments. It is expected that 832 physicians and 1,982 semiprofessional medical workers will be graduated in 1960.

Medical institutes of the Belorussian SSR will admit about 1,200 students in 1960. A stomatological faculty, which is being added to the Minsk Medical Institute, is expected to have 100 students, 50 of whom are expected to attend full time, and the other 50 to study by correspondence.

The amount of money allocated for public health protection in the Belorussian SSR has been increased to about 1.38 billion rubles. This figure is 9.5% higher than the amount spent for the same purpose during 1959.

112. Morphological Changes Linked to Structural Changes in Nucleoproteins Following X Irradiation

"The Problem of the Connection Between Morphological Changes in the Gastric Mucosa of Irradiated Dogs and the Changes in Cellular Nucleoproteins," by A. F. Shveynov, Chair of Pathological Anatomy and Chair of Roentgenology and Medical Radiology, Kursk Medical Institute; Moscow, Arkhiv Patologii, Vol 22, No 3, Mar 60, pp 42-47

In this research, the author attempted to trace the early structural changes in the gastric mucosa, and their link to the changes in nucleoproteins.

The author presents the following conclusions:

1. Structural changes in gastric mucosa cells arise immediately after whole-body X irradiation of dogs by sublethal doses.

2. The radioresistance of the various cells of gastric mucosa is not identical. The cells most sensitive to X irradiation effects are those that contain large quantities of nucleoproteins and have a high mitotic activity.

3. The morphological changes in the cells of gastric mucosa are preceded by changes in the nucleoproteins present in the nuclei and in the cytoplasm. The changes in the nuclear nucleoproteins are the most significant.

113. Change in Oxidative Enzymes Linked to Tissue Hypoxia During Radiation Sickness

"Change in Oxidative Enzymes in Pulmonary Tissue During Acute Radiation Sickness," by A. Ye. Ivanov and N. N. Kurshakova; Moscow, Arkhiv Patologii, Vol 22, No 3, Mar 60, pp 34-42

The purpose of the research described was to study, by histochemical methods, the changes occurring in succinic dehydrogenase and cytochrome oxidase in the pulmonary tissue of rabbits subjected to a single whole-body X irradiation by 800 r.

The author presents the following conclusions:

1. Under the effect of X irradiation by lethal doses, there is a sharp decrease in the activities of succinic dehydrogenase and cytochrome oxidase in the lung tissue of rabbits.

2. The disruption of the activities of these enzymes occurs in accordance with the dynamics of the development of pathological-anatomical changes in the lungs.

3. A comparison of the results obtained in this research (based on histochemical research) with data reported in the literature indicates that the changes in succinic dehydrogenase and cytochrome oxidase which arise in the lungs due to irradiaton form a special case of the general suppression of oxidative enzymes during radiation sickness.

4. The changes in the oxidative enzymes can be one of the causes of tissue hypoxia.

114. Progressive Degenerative Changes Following Intracerebral Radiogold Therapy

"Histopathological Changes in the Central Nervous System After the Direct Administration of Radioactive Gold Into Brain Tissue," by A. M. Vikhert, E. I. Kandel', and F. M. Lyass, Scientific Research Order of Red Banner of Labor Institute of Neurosurgery imeni N. N. Burdenko, Academy of Medical Sciences USSR: Moscow, Arkhiv Patologii, Vol 22, No 3, Mar 60, pp 48-54

In the research described in this article, the authors attempted to obtain data on the reaction of normal brain tissue to the administration of solutions of radioactive gold in experiments on dogs.

The following are the authors' conclusions:

1. Destruction and necrotic processes develop immediately and violently in the area of brain tissue directly affected by Au-198 irradiation. These processes attain maximum intensity on the 9th day after the intracerebral administration of Au-198, i.e., the day when most (90%) of the fissionable energy is absorbed. After this period, when all the radioactive substance is almost completely decayed and its radiation is almost finished, a gradual regression of the above-described pathological processes is observed.

2. The extensive disruption of the permeability of the vascular walls of brain tissue leads to the development of numerous diapedetic intracerebral hemorrhages and to the transudation of plasma into the perivascular spaces due to brain tissue saturation with plasma. The vascular permeability disturbances which arise in the brain tissue and which are significantly removed from the place of Au-198 administration are not the result of the direct effect of gamma irradiation.

3. At later periods, for example, starting with the 6th day after the administration of Au-198, degenerative processes begin to develop in the brain substance. These processes appear in the form of progressive demyelination of the white matter of the brain, which gradually spreads into a large portion of the cerebral hemisphere into which the Au-198 was injected.

115. Use of Bone Marrow Transplantation in Radiation Therapy

" Free Homoplastic Transplantation of Bone Marrow as a Therapeutic Factor in Acute Radiation Sickness," by V. A. Revis, Clinic of Faculty Surgery, Kalinin Medical Institute, First Oblast Hospital; Moscow, Vestnik Rentgenologii i Radiologii, No 2, Mar/Apr 60, pp 44-51

The author reviews briefly Soviet and non-Soviet literature on the subject of radiation therapy and the use of free homoplastic bone marrow transplantations in treating acute radiation sickness.

The following conclusions are presented:

1. Free homoplastic transplantations of healthy bone marrow in acute radiation sickness have a major effect on the recovery of rabbits. Of a total of 13 rabbits irradiated by 700-800 and 1,100 r doses, only three survived; while of 34 rabbits which had been irradiated by similar doses but had received bone marrow transplantations, only three died (of those irradiated by 1,100 r).

2. The course of acute radiation sickness in the rabbits which had received bone marrow transplantations was milder than that of the controls. The symptoms of radiation injuries were less marked, and blood changes were less severe.

3. Histological studies of the bone marrow transplantations revealed that in the beginning, the phenomena of necrobiosis and then necrosis developed. The transplantations became encapsulated and transformed into detritus on the 14th-15th day after transplantation. Regenerations or "taking" of transplantations were not observed.

116. Conference Discusses Extensive Medical Applications of Radioactive Isotopes

"Atoms Serve Peace," by R. Mutseniyek; Moscow Meditsinskiy Rabotnik, No 35 (1887), 29 Apr 60, p 4

The All-Union Conference on the Use of Radioactive Isotopes and Nuclear Radiation in the National Economy has completed its task. Participants in this conference included presidents of scientific research institutes and of sovnarkhozes, and scientists and public health workers.

The conference was opened by Ya. V. Peyve, Chairman of the Council of Ministers Latvian SSR. Among the participating members were the following: P. S. Savitskiy, the chief of the Administration for the Production and Use of Radioactive Isotopes of "Glavatom" (Main Administration for the Peaceful Uses of Atomic Energy) under the Council of Ministers USSR: G. I. Gayle, chairman of the Latvian Sovnarkhoz; G. F. Mikheyev, Senior Scientific Worker of the Institute of Economics, Academy of Sciences USSR; V. S. Sokolov, chief specialist of the State Committee of the Council of Ministers USSR on Automation and Machine Construction; and I. I. Kolomytov, Manager of the All-Union Office "Izotop."

Many prominent scientist-radiologists participated in the medical sessions. A report on the condition and prospects of introducing radioisotopes and nuclear radiations into medicine was presented by Ye. I. Vorob'yev, chief of the Division of Medical Radiology of the Ministry of Health USSR. N. A. Gabelov, Senior Scientific Worker of the Institute of Biophysics, Academy of Sciences USSR, presented interesting data obtained by means of a new type of "gammograph" and an eight-channel radiometer which make it possible to determine the rate of blood circulation in various parts of the body and directly in the cardiac cavity.

Docent V. A. Petrov discussed the system of the organization of dosimetric control in therapeutic institutions of the USSR and standard equipment developed by the Central Scientific Research Institute of Medical Radiology. K. D. Kalantarov, Scientific Worker of the All-Union Scientific Research Institute of Medical Instrumentation and Equipment, reported on data obtained by using small pick-up units for early diagnosis of malignant tumors. Dr M. F. Vyrzhikovskaya talked about instruments and equipment for work in radiological clinics which were designed at the Scientific Research Institute of Experimental Surgical Apparatus and Instruments. Samples of these instruments were displayed at the conference. A. Ya. Berlovskiy, an engineer at the Khar'kov Institute of Medical Radiology, talked about the complex method of protecting people who handle radioactive substances. He suggested the introduction of so-called semiautomatic streamlining for work with radioactive substances to free the personnel from direct contact with these substances.

The conference emphasized the unlimited possibilities for the use of radioactive isotopes, the inadequacy of their current usage, the need to increase the production of powerful sources of ionizing radiations (rotation gamma-apparatus, linear accelerators, etc.), and increasing and improving diagnostic equipment. The training of qualified physician-radiologists and junior medical men and increasing the contact and co-operation of medical men and physicists, especially of radiologists and physicists, was pointed out.

Miscellaneous

117. Medical Equipment

"Apparatuses for the Registration of Cerebral Biocurrents," (unsigned article); Moscow, Meditsinskiy Rabotnik, Vol 23, No 37 (1889), 5 May 60, p 4

Several electronic medical apparatuses for the registration and analysis of cerbral biocurrents have been developed at the Leningrad Designing-Technological Bureau of the Ministry of Health USSR. These include a photophonostimulator which produces light and sound irritants of different intensities, frequencies, and duration; an electroencephalograph which registers the electrical biopotentials of the human cerebrum; ananalyzer which determines the character of the biocurrents; and an integrator which provides figures reflecting the total activity of cerebral biocurrents for any period of time. The apparatuses can record fine measurements of the biocurrents over eight channels. Clinical tests of the equipment produced positive results.

118. General Officers Promoted in Military Medical Services

"Military Ranks Conferred" (unsigned article); Moscow Meditsinskiy Rabotnik, Vol 23, No 38 (1890), 10 May 60, p 2

"On 7 May 1960, the Council of Ministers USSR adopted a decree conferring the following military ranks on officers, generals, and admirals of the Soviet Army and Navy.

"The rank of Lieutenant General of the Medical Services was conferred on Yuvenaliy Mikhaylovich Volynkin. The rank of Major General of the Medical Services was conferred on the following: Aleksandr Nikolayevich Babiychik, Leontiy Ivanovich Gorelov, Boris Dmitriyevich

Ivanovskiy, Porfiriy Yevdokimovich Kalmykov, Boris Mikhaylovich Kornilov, Dmitriy Dmitriyevich Kuvshinskiy, Yoakim Romanovich Petrov, Konstantin Semenovich Petrovskiy, Isaak Iosifovich Rogozin, Georgiy Viktorovich Sinel'shchikov, Vladimir Viktorovich Skvortsov, Yevgeniy Vasil'yevich Smirnov, Aleksandr Viktorovich Triumfov, and Mikhail Ivanovich Chebotarev."

119. Council on Cybernetics Formed

"Cybernetics and Medicine," by Prof V. Parin, Active Member of Academy of Medical Sciences USSR, and D. Menitskiy, chief of Laboratory of Radioelectronics and Cybernetics, Institute of Experimental Medicine; Moscow Meditsinskiy Rabotnik, No 32 (1884), 19 Apr 60, p 2

This article says that sufficient progess has been attained in the field of cybernetics to make it one of the most outstanding achievements of our time. Its impact on biology, medicine, and medical research is already apparent. The application of cybernetic methods in the public health service is expected to improve the statistical tabulation of diseases and to facilate the rapid evaluation of the effectiveness of various preventive measures and therapeutic remedies.

The decree of the CPSU and the government "Concerning Measures for the Further Improvement of Medical Service and Health Protection for the Population of the USSR" contains references to the need for greater expansion of scientific research. The expansion of scientific research is to be based on existing knowledge and achievements in biology, chemistry, nuclear physics, electronics, and cybernetics.

A Scientific Council on Cybernetics has been organized within the framework of the Academy of Medical Sciences USSR; this council has a biological section. Considering the importance of varied and specific features of the problems involved in diagnosis, therapy, prophylaxis, and public health organization, it has been deemed necessary to organize a separate section of medicine also.

New, special laboratories concerned with electronics and cybernetics are being organized in some institutes of the Academy of Medical Sciences USSR. Organizing and equipping them, however, is proceeding very slowly.

Cybernetics has introduced great changes in medical research in laboratories. Erythrohemometers, now in use, make it possible to compute automatically the constituent elements of the blood. Universal analysors of microstructures of biological tissues are under development. They are expected to be used in classifying and computing microelements according to their form, color, density, etc. One such automatic machine can perform the work of 100 laboratory workers.

Electrograms are analyzed with the use of a ruler and a caliper, a tedious and inefficient method. "Periodometers," cyclographs, and other devices which can analyze fluctuations will be used to aid scientists, however. These devices will perform the initial mathematical processing of electrograms. Comparison of the results of an examination obtained by various methods, i.e., the logical process of diagnosis and treatment, could also be subsequently automatized.

Surgical clinics need instruments which can diagnose a case automatically. Successful surgery depends on objectivity, thoroughness, and the speed with which the surgeon can obtain information concerning the patient's condition. The number of instruments which measure and record the vitality of organs and tissues is increasing yearly. There are so many instruments available that one specialist cannot process the data these instruments record.

Objective automatic diagnosis, medical appraisal of physical condition, and forensic medicine are becoming more significant. The mechanical diagnostician will increase the efficiency and effectiveness of work performed, but it cannot replace the physician, because he is the one who will have to make the final decision. Therefore, the fear of some physicians, that medicine as an art will disappear is without foundation. Personal experience, instinct, etc. will still have their places in medical practice. If an abstract thought is studied in detail and presented in the form of an algorism (a sequence of elementary rules and operations), a machine will be able to perform useful work rapidly and accurately without interference from the human intellect. This work can be very useful both in theoretical and practical medicine.

It can be assumed that the development of diagnostic computers will proceed in two directions. First of all will be large machines electronic or electromechanical for special clinics which will hold in their "memory" up to 10,000 "symptoms" of approximately 100 different diseases. These machines will represent convenient automatic reference books, the recommendations of which can be constantly corrected in line with the latest progress made in diagnosis. The other type of machine will have a greater "memory" capacity and will be utilized in large scientific centers. Such diagnostic machines are being tested at the Computer Center of the Academy of Sciences Ukrainian SSR and in the Laboratory of Electromodeling, Academy of Medical Sciences USSR. The performance of these machines has been encouraging.

Artificial organs and limbs can serve as an important area for the application of the ideas and methods of cybernetics in medicine. They include artificial extremities controlled by bioelectric impulses. A

A special converter-transducer can be made to provide "sensitivity" to environmental conditions for these artificial parts. The development of automatic instruments and manipulators which make use of such factors as temperature, color, density, and firmness of tissue could make it possible to carry on selective internal surgery on a living organism in places inaccessible to the human hand.

A possibility appears to exist for the complete automatization of factors that control artificial respiration and circulation on the basis of analysis of the properties and composition of the blood.

Experiments on the automatic regulation of arterial pressure, performed with the aid of electric stimulation are of interest. When pressure in the femoral artery of an experimental animal (dog) is increased, the electronic device produces low-frequency electric impulses which act on the depressor, causing dilation of blood vessels and a resulting drop in blood pressure. It is suggested that it will be possible to design, at some future time, a small, portable apparatus for use in hypertension cases. Such an apparatus will be able to maintain a normal level of arterial pressure. Research is being conducted to develop artificial organs of sensation, hearing, and vision.

The mechanics at the basis of the regulation of physiological processes in living organisms have features that are similar to the principles of the operation of artificial automatic systems. A study of common principles leads to the mutual enrichment of related sciences and permits the utilization of the entire arsenal of knowledge in natural sciences and engineering for the solution of complicated problems in biology and medicine.

The need for further automatization of production has arisen. This need is dictated by life itself. It is necessary to investigate in greater detail the forms and physiological processes of physical and mental work, to determine the complexity and difficulty of operations performed, and to clarify the conditions necessary for increased safety and efficiency of labor. Progress in this direction has been very slow. It is time to improve the administrative machinery, raise the qualifications of existing personnel, and train new people.

Scientists, engineers, and physicians must pool their resources and coordinate their efforts to make greater progress in the realm of medical science.

120. Forensic Medicine Experts Meet

"Conference of Chief Medicolegal Experts," by S. Prilutskiy; Minsk, Zdravookhraneniye Belorussii, No 3, Mar 60, p 75

According to this article, many directors of chairs of legal medicine and practical workers of oblast bureaus of medicolegal expertise took part in the conference of chief medicolegal experts of the Ministries of Health of the union republics, held in Moscow.

V. I. Prozorovskiy, head of medicolegal expertise of the Ministry of Health USSR, read a report in which he discussed the problems with which medicolegal expertise in the USSR is confronted as a result of passage of the penal law by the second session, fifth convocation, of the Supreme Soviet USSR. He pointed out that the need now exists for workers in legal medicine and chemistry to improve their qualifications.

Seven principal experts in legal medicine read reports on the status and long-range development of legal medical expertise in the union republics. Directors of departments of the Institute of Legal Medicine read reports on the progress made to date in solving the main scientific problems of legal medicine.

A plenum of the board of directors of the All-Union Society of Legal Medical Workers and Criminologists was held after the conference finished its business. V. I. Prozorvskiy chairman of the board of directors, read his report at this plenum. Each chairman of the board of directors of six branches also presented a report.

V. M. Smol'yaninov reported on the activity of Sudebnomeditsinskaya Ekspertiza (Medicolegal Expertise) during the first year of its publication, and described plans for its immediate future.

More than 40 people took part in the discussions. A. I. Burnazyan, Deputy Minister of Health USSR, delivered a long speech in which he analyzed the duties of medicolegal expertise in the USSR.

VIII. METALLURGY

Physical Metallurgy

121. Phase Studies of Fe-Cr-Ti Alloys Rich in Iron and Chromium

"Investigation of the Phase Diagram of Iron-Chromium-Titanium in the Region of Alloys Rich in Iron and Chromium," by N. G. Boriskina and I. I. Kornilov; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 1, Jan/Feb 60, pp 50-58

Results are presented of studies of the phase diagram of the Fe-Cr-Ti system adjacent to the Fe-Cr side and measurements of hardness at 1,000 and 550°C. A ternary intermetallic compound with the composition $Ti_5Cr_7Fe_{17}$ (α-Mn type) was detected which formed according to the peritectic reaction $Zh + \alpha \rightarrow X$, $Zh + \gamma \rightarrow X$. This compound forms a narrow region of solid solutions with α- and γ-phases which disintegrate at 1,000 and 550°C with the formation of a $TiFe_2$ phase. It was established that crystallization in the region of alloys adjoining the Ti-Fe side, in alloys of the $TiFe_2$ section, and in a wide region of alloys lying to the right of this section with a higher content of chromium has an eutectic character. The region of a ternary solid solution on a Fe and Cr base is located along the Fe-Cr side at 1,000 and 550°C. At 1,000°C, the solubility of Ti in the α solid solution from the Ti-Fe side increases approximately 5% on the average; at 550°C; the solubility of Ti decreases. Fe-Cr-Ti alloys have maximum hardness in the annealed state in the X-phase region which disintegrated with the formation of the compound $TiFe_2$.

122. Structure and Properties of V-W Alloys

"Structure and Properties of Alloys of the System Vanadium-Tungsten," by V. V. Baron, Yu. V. Yefimov, and Ye. M. Savitskiy; Moscow, Izvestiya Akademii Nauk SSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 1, Jan/Feb 60, pp 70-74

Microhardness, hardness, ductility, strength, and oxidizability of alloys of vanadium with tungsten with vanadium concentrations ranging from 0.7 to 99.95% by weight were investigated, and a phase diagram was constructed for the system. Results showed that vanadium and tungsten form a continuous series of solid solutions. At a tungsten concentration of 4.5% by atomic weight, the solidus and liquidus lines have a clearly defined miniumum equal to 1,635°C; however, no transformations in the solid state were noted for alloys lying in this region. Small additions

of tungsten to carbon reduced vanadium (98.6% pure) causes an increase in ductility, decrease in hardness, and a small increase in the compression strength of the latter. Further increase in the content of tungsten produces a change in properties characteristic of a system with continuous solubility in the solid solution. Vanadium decreases the oxidation resistance of tungsten. At temperatures of 700 to 1,000°C, all of these alloys, as well as the initial metals, are easily oxidized.

123. Study of the Pseudobinary CrB_2-Mo System

"Interaction of Chromium Boride With Molybdenum," by T'ai Shou-wei, G. A. Yasynskaya, and G. V. Samsonov, Institute of Powder Metallurgy and Special Alloys, Academy of Sciences Ukrainian SSR; Kiev, Dopovidi Akademii Nauk Ukrains'koi RSR, No 1, 1960, pp 48-50

Metallographic, thermal, and dilatometric analyses and measurements of electrical resistance, thermo-emf, and shrinkage during sintering were performed in a study of alloys of the pseudobinary system CrB_2-Mo. It was shown that the CrB_2-Mo diagram has an eutectic character with an eutectic point (1,960°C) at which the content of CrB_2 is 17% by molecular weight and one at ~2,120°C at which the CrB_2 content is 94% by molecular weight. The solubility of CrB_2 in molybdenum at the first eutectic temperature does not exceed 3% by molecular weight, whereas the solubility of molybdenum in CrB_2 at the second eutectic temperature does not exceed 1% by molecular weight. In this system, there exists the compound Cr_2MoB_4 which melts congruently at 2,270°C.

124. Acid Resistance and Analytical Determination of Titanium, Zirconium, Niobium, and Tantalum Nitrides

"The Acid Resistance and Methods for the Analysis of Nitrides of Titanium, Zirconium, Niobium, and Tantalum," by O. I. Popova and G. T. Kabannik, Institute of Powder Metallurgy, Cermets, and Special Alloys, Academy of Sciences, Ukrainian SSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 4, Apr 60, pp 930-934

The solubilities of TiN, ZrN, NbN, and TaN in acids were determined, as well as their solubilities in caustic and mixtures of caustic with hydrogen peroxide. It was established that the greatest resistance to the action of the solvents in question is exhibited by TaN and the least by ZrN. The results of the investigation have been applied in the development of methods for the dissolution of samples of the nitrides for analysis. Procedures are given for the analysis of the nitrides in question.

125. Sintering Temperature Versus Pore Form in Powdered Metal Antifriction Materials

"Effect of the Temperature of Sintering on the Form of Pores in Powdered Metal Antifriction Materials," by I. M. Fedorchenko, Corresponding Member of the Academy of Sciences Ukrainian SSR, and O. Ya. Artamonov, Institute of Power Metallurgy and Special Alloys, Academy of Sciences Ukrainian SSR; Kiev, Dopovidi Akademii Nauk Ukrains'koi RSR, No 1, 1960, pp 44-47

Investigations of approximately 2,000 specimens of antifriction materials made of iron and iron-graphite powders established that the form of pores is determined mainly by the temperature of sintering. Sintering at 1,050°C (perlite region) produces branched pores, whereas sintering at 910°C (Ferrite region) produces spheroidal pores. Bearings sintered at 1,050°C have higher permeability and lubrication characteristics and, subsequently, longer life.

126. Al-Zn-Ca Alloys for Anticorrosion Protection of Marine Vessels

"Application of Aluminum-Zinc-Calcium Protectors for Anticorrosion Protection of Marine Vessels," by I. M. Frantsevych, Corresponding Member of the Academy of Sciences Ukrainian SSR, and E. L. Pechentkovs'kyy, Institute of Powder Metallurgy and Special Alloys, Academy of Sciences Ukrainian SSR; Kiev, Dopovidi Akademii Nauk Ukrains'koi RSR, No 1, 1960, pp 36-39

Results are presented of a one-year test of anticorrosion protectors made of alloys ATsK-11 (Zn base, 14.5 to 18.0% Al, 3.5 to 4.5% Ca, and 0.2 to 0.3%Mn), ATsK-12 (Al base, 14.0 to 17.0% Zn, 4.5 to 5.0% Ca, and 0.3 to 0.4% Mn), and magnesium-base alloys. Specimens were tested on a Black Sea vessel under natural marine conditions. It was established that although Al-Zn-Ca alloys have a lower anode current density than magnesium-base alloys, their service life is 8-10 times longer. No passivity was noted for alloys of the Al-Zn-Ca system.

127. Refractory Aluminum Oxide -- NiAl Cermet

"Investigation of Combinations of Mikrolit With the NiAl Intermetallic Compound," by V. P. Yelyutin, I. I. Kitaygorodskiy, Ye. I. Mozzhukhin, and V. B. Rabkin, Moscow Steel Institute and Moscow Chemicotechnological Institute; Leningrad, Zhurnal Prikladnoy Khimii, Vol 33, No 3, Mar 60, pp 559-563

It was established that introduction of NiAl into mikrolit increases the heat resistance of this material, although it lowers its strength and hardness. It was furthermore established that the presence of NiAl in

mikrolit does not exert any effect on processes taking place during the sintering of this material. During sintering at temperatures higher than the melting point of NiAl, coalescence of particles of NiAl takes place.

/SIR Note: Mikrolit is an artificial corundum material of the cermet type which is distinguished by its ultramicroscopic structure and great hardness. It was developed in the USSR in 1950 (cf. Bol'shaya Sovetskaya Entsiklopediya /Large Soviet Encyclopedia/, 2d edition, Vol 27, 1954, p 442)./

128. Preparation of Borides of Metals of the II a Subgroup of the Periodic System

"Preparation of Borides of Metals of the II a Subgroup of the Periodic System," by G. V. Samsonov and T. I. Serebryakova, Institute of Powder Metallurgy, Cermets, and Special Alloys, Academy of Sciences Ukrainian SSR; Leningrad, Zhurnal Prikladnoy Khimii, Vol 33, No 3, Mar 60, pp 563-569

It was established that Be_2B forms predominantly as a result of vacuum-thermic reduction of beryllium oxide with boron carbide, boron, or mixtures of boron with boron carbide. The phase consisting of Be_2B also has the greatest tendency to form when beryllium combines directly with boron. In addition to Be_2B, the phase BeB_4 is formed, which is distinguished by a tetragonal lattice of the UB_4 type. There is also formation of a phase, the composition of which corresponds approximately to the formula BeB_6. In the system Mg-B, reduction of magnesium oxide with boron in vacuum leads to the formation of phases, the composition of which is close to that of compounds having the formulas MgB_4 and MgB_6.

A vacuum-thermic method has been developed for the preparation of the hexaborides of calcium, strontium, and barium by reduction with boron, boron carbide, or a mixture of boron with boron carbide. Application of this method assures formation of products, the composition of which is close to the stoichiometric.

The borides of beryllium, magnesium, calcium, strontium, and barium are of considerable importance from the standpoint of their application in electronics as materials for cathodes or as components of complex cathode compositions (cf G. V. Samsonov and L. Ya. Markovskiy, Uspekhi Khimii, Vol 25, 1956, p 190). Being hard and high-melting materials, they may be applied as components of heat-resistant alloys and other special alloys. Furthermore, they are of considerable interest in connection with processes for the metallothermic production of elemental boron. Satisfactory methods for their production were not available hitherto.

129. Chemical Stability of Diborides of Some Transitional Metals and Their Decomposition by Interaction With Acids

"The Chemical Stability of Diborides of Some Transitional Metals and Their Hydrolytic Decomposition Upon Interaction With Acids," by L. Ya. Markovskiy and G. V. Kaputovskaya; Leningrad, Zhurnal Prikladnoy Khimii, Vol 33, No 3, Mar 60, pp 569-577

The stability of ZrB_2, TiB_2, and CrB_2 toward the action of HCl, H_2SO_4, and HNO_3 was investigated. Their stability was compared with that of the acid-resistant compounds B_4C and $MoSi_2$ on the basis of tests made with powdered and sintered samples. The behavior of borides prepared by three different methods (reduction with carbon of a mixture of metal oxide and boron, reduction in vacuum by the boron carbide method, and electrolysis of melts by L. Andrieux's method) was compared. It was established that sintered TiB_2 is sufficiently stable to the action of hydrochloric acid to be considered an acid-resistant material. Addition of silicon to titanium boride and zirconium boride was found to lower the stability of these compounds to acids. The results obtained indicate that when the borides investigated are subjected to the action of acids, the radical BH_3 is formed by acid hydrolysis. The radical BH_3 reacts, forming boron hydrides (B_2H_6 and B_4H_{10}), the presence of which was detected. The boron hydrides are hydrolyzed further, forming hydrogen and boric acid.

The borides in question are of interest as construction materials which have very high melting points and exhibit a high heat conductivity, a high electrical conductivity, and a relatively great resistance to the formation of scale.

130. Possibilities of Improving the Properties of Boron Carbide by Combining It With Titanium and Chromium Borides

"Some Properties of Alloys of Boron Carbide With Titanium Boride and With the Binary Titanium-Chromium Boride," by K. I. Portnoy, G. V. Samsonov, and K. I. Frolova; Leningrad, Zhurnal Prikladnoy Khimii, Vol 33, No 3, Mar 60, pp 577-582

Boron carbide (B_4C) appears to be of advantage as a component of heat-resistant alloys because of its great hardness and high resistance to erosion. However, it is rather brittle and does not have a sufficient resistance to oxidation or heat. An attempt has been made to improve the properties of boron carbide in these respects by combining it with titanium boride and the binary titanium-chromium boride. The alloys of boron carbide with the metal carbides were prepared by pressing mixtures of powders of

the carbides in question at 2100-2400° for 5-10 min. It was established that alloying of boron carbide with TiB_2 + CrB_2 results in products which have a heat resistance and resistance to oxidation superior to those of alloys with an individual boride. However, the general level of heat resistance of alloys in the system TiB_2 - B_4C is inadequate, so that these alloys can be used only when a short time of service is required. It was established that the B_4C-TiB_2 and B_4C - $(Ti, Cr)B_2$ alloy systems are of the eutectic type with high melting points of the eutectics (1900° in the case of B_4C - TiB_2).

131. Tetraammoniate and Aminocomplex Compounds of Rhenium Trichloride

"Synthesis and Thermal Decomposition of the Tetraammoniate and Aminocomplex Compounds of Rhenium Trichloride," by Miao Ch'ing-sheng and V. G. Tronev; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 4, Apr 60, pp 861-869

The tetraammoniate, tetraethylamine, tetradiethylamine, and tetrapyridine compounds of rhenium trichloride were synthesized, i.e., compounds of the type $ReCl_3 \cdot 4\ Am$ (where Am = NH_3, $C_2H_5NH_2$, $(C_2H_5)_2NH$, or C_5H_5N). It was established that as far as thermal stability is concerned (i.e., on the basis of the temperatures at which decomposition begins), the compounds mentioned can be arranged in the following order:

$$ReCl_3 \cdot 4\ NH_3 \underset{345^\circ}{>} ReCl_3 \cdot 4\ C_2H_5NH_2 \underset{320^\circ}{>} ReCl_3 \cdot 4(C_2H_5)_2NH \underset{268^\circ}{>}$$

$$> ReCl_3 \cdot 4\ Py \underset{260^\circ}{}\ .$$

It was established that on heating and washing with liquid ammonia, $ReCl_3 \cdot 4\ NH_3$ undergoes ammonolysis with the formation of amido-compounds in which the bond between Re and N remains intact up to 500°. The assumption is made that the above-mentioned tetraamine compounds of rhenium tetrachloride are of the coordination type, which is confirmed by the fact that a coordination compound between $[Re\ Py_4]^{3+}$ and $[ReCl_3\ OH]^-$ is formed.

132. Superior Forgings Produced by Vibration Deformation

"Vibration Method of Deformation," by M. Ya. Karnov and A. A. Voronin; Moscow, Kuznechno-Shtampovochnoye Proizvodstvo, No 3, Mar 60, pp 3-8

The design and operation of an experimental vibration press are described, and results are presented of tests on the vibration deformation of steel 40KhNMA, aluminum alloys AK-6 and VD-17, and the titanium alloy VT-2. Billet deformation was initiated by joint action of the static force from the hydraulic system of the press and an additional adjustable pulsating load transmitted through a vertical column to the upper die section. Advantages claimed for the vibration method of deformation are as follows:

1. Deformation is more uniform throughout the volume of the material being deformed.

2. Friction on contact surfaces is decreased up to 60%.

3. Ductility of the worked material is increased up to 40% as in the case of light and titanium alloys, engineering steels, and others.

4. Pressure is decreased 25-50%, thereby increasing tool life and decreasing the power required for equipment.

5. Precision is increased considerably. In the case of vibration stamping of blades made of alloy VD-17, blade tolerances of ±0.05 mm were achieved prior to polishing with higher surface quality than obtained in mechanical forging or stamping presses.

Vibration deformation tests were conducted in a forge shop of an unidentified plant. Participants in the experimental portion of the work were engineers V. I. Vlasov, B. I. Petrov, A. F. Rogachevskiy, V. A. Filatov (decreased), M. S. Sotskiy, and S. N. Shestakov. Curves for the ductility of titanium alloy VT-2 during upsetting on a stamping press and hammer forge were borrowed from works by A. A. Nikol'skiy.

133. Quality Control of Forgings Made of Steel EI481 and Alloy EI437B

"Effect of Reduction in Forging on the Penetrability of Ultrasonic Waves in Forgings Made of Highly Alloyed High-Temperature Steels and Alloys," by M. Ya. Dzugutov, Yu. V. Vinogradov, and V. P. Stepanov; Moscow, Kuznechno-Shtampovochnoye Proizvodstvo, No 3, Mar 60, pp 10-13

Tests with steel EI481 and alloy EI437B indicated that the magnitude of total deformation during otherwise equal conditions is the determining factor in the permeability of forgings to ultrasonic waves. With increase in the coefficient of reduction in forging (up to a predetermined limit), the permeability of forgings is improved. Permeability to ultrasonic waves may vary with the type of steel or alloy as specifically indicated by the higher permeability of EI481 steel forgings as compared to that of alloy EI437B forgings. Heating and holding of forgings at a temperature somewhat higher than the temperature of the beginning of recrystallization improves permeability to ultrasonic waves. Heating at higher temperatures results in more complete and rapid recrystallization, but could result in coalescence which in turn would decrease the permeability of forgings.

Low Temperature Physics

134. Second Sound in He II

"Second Sound in Helium II," by V. P. Peshkov, Institute of Physical Problems, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 3, Mar 60, pp 799-805

Second sound in helium was investigated by the resonance method at temperatures down to 0,38°K. Damping of second sound is so large at temperatures below 0.5°K that no resonances are observed and second sound changes into highly damped thermal waves. The experimental values of u_2 from the λ point down to 0.55°K (1958 temperature scale) are presented. It is shown that the calculated values of u_2 obtained by Berdt et al. (Phys. Rev., 113, 1386, 1959) on the basis of data on cold neutron scattering in helium are in good agreement with straightforward second sound velocity measurements.

Mechanics

135. Gaseous Detonation

"The Structure of Gas Detonation in Pipes," by Yu. N. Denisov and Ya. K. Troshin, Institute of Chemical Physics, Academy of Sciences USSR and Institute of Chemical Kinetics and Combustion, Siberian Branch, Academy of Sciences USSR; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 4, Apr 60, pp 450-460

The results of an experimental study of gas detonation wave structure in pipes by a method of photorecording of improved resolution and by a "follow-up" (trace?) method are reported. It is shown that the flat forward detonation front is missing and a dominant role is played by the curving of this front in the process of propagation of the chemical reaction. The detonation is subdivided into a spin and a pulse propagation. In the pulsing detonation, the propagation of the wave of the chemical reaction has a periodic character. The spin detonation is considered as a boundary case of the pulsing detonation in which the curving has an independent existence with localization of the chemical reaction in it. Some quantitative relations for certain parameters of the detonation wave to the initial pressure of the burning mixture and the distribution of the tangential componenet of the velocity of the gas at the front of the detonation are presented.

136. Production of Shock Waves

"Experimental Study of a Directed Gas Stream at a Pulse Discharge," by S. R. Kholev and L. I. Krestnikova, Moscow State University imeni Lomonosov; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 1, 1960, pp 29-37

The possibilities of obtaining slightly damped waves over a considerable distance, i.e., obtaining quasistationary gas streams at supersonic speeds, originating at pulse discharge in a cylindrical channel, are studied, as well as some properties of these streams in relation to initial pressure, kind of gas, and parameters of the discharge circuit, including the use of essentially different condensers. It was found that a condition necessary for the formation of shock waves is a short free flight of molecules and atoms of the gas in comparison with the dimensions of the vessel.

137. Mechanical Systems With Variable Mass

"The Motion of Mechanical Systems With Connections, Depending on the Process of Change of Mass," by V. S. Novoselov; Leningrad, Vestnik Leningradskogo Universiteta, Seriya Matematiki, Mekhaniki i Astronomii, No 1, 1960, pp 132-141

Earlier works by the author (Vestnik LGU, No 19, 1956; No 1, 1957; No 7, 1959) considered the problem of the mechanics of changing masses, with internal motions of the particles taken into account. In these works, it was assumed that the change of mass did not change the kinematics of the system. This article elaborates on the results obtained earlier for mechanical systems with connections which change with the change of mass.

138. Corrections for Nonstationary Flow Near the Automodeling

"The Problem of a Nonstationary Motion Near the Automodeling," by T. G. Koldobskaya; Leningrad, Vestnik Leningradskogo Universiteta, Seriya Matematiki, Mekhaniki i Astronomii, No 1, 1960, pp 111-122

In recent years, several works in gas dynamics have been devoted to methods of investigating the self-modeling motions of a gas, which are determined analytically on the basis of the fact that, in the system of equations which characterizes them, a substitution of variables can be made so that the number of independent variables will decrease. This property of self-modeling motions considerably simplifies the general equations and affords the possibility of treating a whole series of practical problems, the solution of which generally involves insurmountable difficulties.

The purpose of the present work is to determine the hydrodynamic elements of a two-dimensional or axially symmetrical nonstationary motion near the self-modeling, i.e., to obtain the corrections for the known automodeling solution.

When an arbitrary self-modeling problem may be solved for a wedge (or cone) with an arbitrary opening angle (or if the corresponding experimental data is available), it can be assumed that the solution of the problem gives, in a certain unique linear arrangement, a flow of the same nature around an arbitrary cylindrical (or axisymmetrical) body, the generated contour profile of which does not change abruptly.

Nuclear Physics

139. Vertical Betatron Oscillations

"Evaluation of Amplitude Variations of Vertical Betatron Oscillations in Accelerators at Extraction of the Beam With a Regenerative Deflector," by Yu. Ya. Lembra, Physicotechnical Institute, Academy of Sciences USSR, Leningrad, and Tartu State University; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 4, Apr 60, pp 405-412

A new method of computed envelopes is applied to the study of amplitude variations of vertical betatron oscillations at extraction of the charged particle beam by means of a regenerative deflector. Accelerators are analyzed in which the particles move in magnetic periodic systems. As a measure of the amplitude variations of the vertical betatron oscillations, the ratio of envelopes of the disturbed and the nondisturbed motions is chosen. By means of averaging (according to the elements of periodicity of the magnetic system) of the square of the maximum of this ratio with respect to the initial phase of betatron oscillations, a simple evaluation is obtained (in the case of a narrow regenerator) of the amplitude variation of vertical betatron oscillations.

140. Ionization Chamber Characteristics

"Effect of Ionization Structure on the Volt-Ampere Characteristic of a Liquid Ionization Chamber," by V. I. Ivanov, Moscow Engineering Physics Institute; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 1, 1960, pp 119-123

Some results are presented from experimental studies of the volt-ampere characteristic of a liquid ionization chamber irradiated by X-rays. An empirical formula was derived yielding the first section of the volt-ampere curve. The variation of the space distribution of ions in a dielectric liquid with varying applied voltage was studied.

141. Measurements of Gamma Energy

"Comparison of Ionization and Calorimetric Measurements of Gamma Ray Flux Energy From a Synchrotron," by S. P. Kruglov, Z. Kovarzh, and I. V. Lopatin, Leningrad Physico-technical Institute; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 1, 1960, pp 3-11

Measurements of gamma ray flux energy, necessary for determination of cross sections of photonuclear reactions, were carried out by calorimetric and ionization methods in order to find the reason for discrepancies reaching 25-30% in using different methods. It has been found that the best and most dependable method of measurement is the calorimetric one, under the assumption that the whole absorbed energy of the gamma beam is converted into heat, and no chemical or crystalline structure changes occur. The method of transient curves gives low accuracy in the case of substances with high Z (lead); while in the case of low Z (C, Al, Cu), the results obtained by the method of transient curves compare favorably with those obtained by a calorimeter.

142. Scintillation Spectrometer

"Scintillation Spectrometer of Fast Neutrons," by A. G. Khabakhpashev; Moscow, Pribory i Tekhnika Eksperimenta, No 1, Jan/Feb 60, pp 25-29

The scintillation spectrometer was improved by using a stilbene crystal as detector of scattered neutrons, while the average energy of scattered neutrons was increased. Its principle of action is based on measurement of the spectrum of recoil protons accompanied by scattered neutrons of a certain energy. The scattered neutrons are separated by their flight time. The characteristics of the spectrometer are described, and the results of measurement of the spectrum of a Po - Be source are given. The high efficiency of the device permits measuring the spectra of sources with an intensity of ~ 200,000 neutrons/sec.

143. Cherenkov Spectrometer

"Cherenkov Spectrometer for Measuring Gamma Quanta Energy," V. S. Pantuyev, M. N. Khachaturyan, and I. V. Chuvilo, Joint Institute for Nuclear Research; Moscow, Pribory i Tekhnika Eksperimenta, No 1, Jan/Feb 60, pp 19-24

The construction and operation of a Cherenkov gamma spectrometer, designed for measuring gamma quanta in a range from 100 Mev to several Bev, are described. The gamma quantum excites in the radiator of lead glass an electron-photon avalanche, with most of its energy absorbed in

the radiator. As an energy measure of the primary quantum, the amount of Cherenkov light is taken, emitted by the charge component of the avalanche. The spectrometer is tested and calibrated by monoenergetic electrons within the range of 100 to 230 Mev. The energy resolution of the spectrometer at 200 Mev equals ± 40%. The spectrometer has a 100% efficiency and is linear in the considered energy range.

144. Gas Discharge Counters

"Performance of Gas Discharge Counters at High Pulse Overvoltages," by B. A. Dolgosheyn, B. I. Luchkov, and V. I. Ushakov; Moscow, Pribory i Tekhnika Eksperimenta, No 1, Jan/Feb 60, pp 39-42

The characteristics of counters MS-9, GS-9, and GS-30 operating under controlled pulses were studied. The dependence of time, during which the counter "remembers" the ionization, on the conditions of pulse operation was tested. A simple method of measurement of the velocity of propagation of the discharge along the fiber of the counter is described.

145. Photodisintegration of N-14 Nuclei

"Photodisintegration of N-14 Nuclei," by A. P. Komar, Ya. Krzhemenek, and I. P. Yavor, Physicotechnical Institute, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 131, No 2, Mar 60, pp 283-285

The reaction (γ n p) was studied by means of a Wilson chamber located in a constant magnetic filed (H = 6700 oersted) and synchronized with a synchrotron, with auxiliary equipment as described by the authors in ZhTF, 27, 868 (1957). The experiments on photodisintegration of N were carried out at a maximum of gamma radiative capture energy of 90 Mev. It was found from comparison of the obtained results with computation based on D. H. Wilkinson's (Physica, 22, 1039, 1956) model that most (γ , p) reactions on N are due to a resonance process. The energy spectrum of protons from the (γ n, p) reaction is presented in a graph showing a maximum at 1.5 Mev.

146. Helium Scintillator

"Investigation of Scintillations in Helium at Liquid Helium Temperatures," by B. V. Gavrilovskiy; Moscow, Atomnaya Energiya, Vol 8, No 4, Apr 60, pp 363-365

The luminescence mechanism of pure helium was studied in a wide range of pressures. It has been suggested by the author and others (Atomnaya Energiya, 3, 10, 331, 1957) to use a He scintillator under high pressure for measuring the polarization of fast neutrons. For this purpose, a He scintillator cooled to temperatures of liquid He was investigated. The density of the scintillator at pressures not exceeding the critical He pressure (2.2 atm.) may be varied in a wide range down to liquefaction of the scintillating gas. It was found that scintillations have the same amplitudes in liquid as in cooled He gas. The yield of light was the same in liquid He when the temperature went down below the lambda point. Experiments with He-3 gave the same results.

147. Uranium Fission

"Fission of Uranium Nuclei Induced by 9 BeV Protons," by N. A. Perfilov, V. F. Datovskikh, G. F. Denisenko and A. I. Obukhov, Radium Institute, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 3, Mar 60 pp 716-718

Some characteristics of uranium fission produced by 9 BeV protons are obtained, including the magnitude of the cross section, dependence of yield on ratio of fragment ranges, data on number of light charged particles involved in fission, and the angular distributions of the fragments.

148. Nuclear Spectroscopy Conference Materials

Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, Vol 24, No 3, Mar 60, (Moscow)

The entire issue of the source is devoted to materials of the Tenth All-Union Conference on Nuclear Spectroscopy, held in Moscow 19-27 January 1960. Reports presented include the following:

"Alpha Emission of U-233," by B. S. Dzhelepov, R. B. Ivanov, V. G. Nedoyedov, and Yu. T. Puzynovich, Radium Institute imeni Khlopin, Academy of Sciences USSR, pp 258-260

A magnetic alpha-spectrometer was used to continue research on alpha emission of U-233. The obtained results, showing the energy values of excited levels, the intensities of alpha transitions at these levels, quantum characteristics of levels, and the value of the forbiddance factor F for alpha transitions, are represented in tables.

"Study of Radioactive Decay of Th-231," by S. A. Baranov, R. M. Polevoy, Yu. F. Rodionov, G. V. Shishkin, and V. M. Shubko, pp 261-271

A sample of thorium strongly enriched with Th-230 was used for the study of beta-decay of the isotope for a schematic diagram of energy levels of the Pa-231 nucleus. The tabulated results were close to the schematic predicted by S. Nilsson (S. Kgl danske vid. selskab. Mat.-fys. medd., 29, 16 (1955)).

"Conversion Electrons and Gamma Rays of Tu-165," by K. Ya. Gromov, B. S. Dzhelepov, A. G. Dmitriyev, V. A. Morozov, and K. I. Yakovlev, pp 272-277

The emission spectrum of Tu-165 in the range over 350 keV has been studied. It was found that the scheme of decay of Tu-165 is more complicated than previously suggested with many heretofore unnoticed gamma transitions.

"The 75-Minute Activity of Yb," by A. A. Abdurazakov, K. Ya. Gromov, B. S. Dzhelepov, Yu. V. Norseyev, G. Ya. Umarov, and V. G. Chumin, Laboratory of Nuclear Problems, Joint Institute for Nuclear Research, Central Asia Polytechnic Institute, pp 278-281

A magnetic beta-spectrometer with a homogeneous magnetic field was used for studying the spectra of electrons and positrons produced during the 75-minute decay of an ytterbium isotope. The positron spectrum showed that the intensity drops with a half-life period of 75 ± 2 minutes. The spectrum of conversion electrons revealed L- and M-lines of transitions at 91.5 keV and K- and L- lines of transitions at 211 keV.

"The Beta Decay of La-140," by B. S. Dzhelepov, B. A. Yemel'-yanov, K. P. Kupriyanova, and Yu. N. Podkopayev, Scientific Research Physics Institute Leningrad State University imeni Zhdanov; pp 288-290

A new beta spectrometer of the institute was used for studying the electron emission of La-140 within the energy range of 1800 to 4000 keV. The energies of corresponding gamma transitions and the intensities of conversion lines are tabulated.

"Study of Positron Spectra of Neutron Deficient Isotopes," by N. A. Bonch-Osmolovskaya, B. S. Dzhelepov, and O. Ye. Kraft, pp 283-287

The positron spectra of some neutron deficient isotopes (lutecium, erbium, dysprosium) obtained by bombarding a tantalum target with fast protons (E_p = 680 Mev) have been studied. The experiments were carried out by using a beta-spectrometer with triple focusing, as previously described by the authors (ibid., Vol 20, 1956, p 318).

"Relation of the Amplification Factor of Photoelectron Multipliers to the Amplitude of Pulses and the Interval Between Them," by A. G. Berkovskiy and V. G. Polskiy, pp 377-379

Special equipment was built, and several tens of photomultipliers (mostly FEU-33) were tested for a quantitative evaluation of possible errors in measurements over a wide range of counting velocities. The results of measurements are represented in graphs as a ratio of the amplification factor to the time interval between pulses. The curves show that the FEU-33 tubes have a relaxation time of up to 3 mcsec, and the RCA-6810A and RCA-6342, 15-20 mcsec.

149. New Soviet Reactor

"The Physics Institute of the Academy of Sciences of the Ukrainian SSR" (interview with the Deputy Director of Scientific Research of the Physics Institute, Academy of Sciences Ukrainian SSR), by V. Parkhit'ko; Moscow, Atomnaya Energiya, Vol 8, No 4, Apr 60, pp 380-381

 The text of the interview is as follows:

The reactor VVR-M of 10,000 kw power was set in operation in February 1960 at the Institute of Physics, Academy of Sciences Ukrainian SSR. The following research will be carried out on this reactor:

1. study of resonance scattering of slow neutrons by the time-of-flight method, to this end, a mechanical selector and a 1024-channel time analyzer have been set up. This research will be carried out by M. V. Pasechnik, V. P. Vertebnyy, and R. G. Ofengenden;

2. study of spectra of captured gamma rays (a wide angle gamma spectrometer with a capture angle of 80° has been devised). The research will be carried out by M. V. Pasechnik and M. F. Barchuk;

3. study of the lifetime of short-lived isotopes.

Besides the enumerated studies, the reactor will be used for research in radiation chemistry and radiation biology.

In 1959, work was carried out on the cyclotron which has been operating at the institute since 1957, on studies of angular distribution in stripping reactions on 11 isotopes. The associates of the institute, O. F. Nemets and N. I. Zaikina, obtained values of energies of levels, spins, and parities. In addition values were obtained for angular distribution of elastic and inelastic scattering of deuterons, as well as deuterons and tritons from reactions pD and DT. Conclusions were drawn on the mechanism of nuclear reactions. This work was carried out by O. F. Nemets, L. S. Saltykov, and M. V. Sokolov. Angular distribution of elastically and inelastically scattered neutrons was measured. The study of elastic scattering on isotope targets such as Ni-58, Ni-59, Ni-60 slowed up a sharp difference in the character of angular distributions which cannot be explained within the framework of an optical model. M. V. Pasechnik and N. N. Pucherov measured the polarization of protons at elastic scattering.

These measurements are supposed to be further developed in 1960. Simultaneously with this, extensive studies will be under way at the institute concerning the proton polarization in stripping reactions, angular Dp gamma correlations, and Dn- and $d\alpha$-reactions. Suitable equipment has been developed and partially tested.

In 1959, V. I. Strizhak studied on an electrostatic generator and low-voltage neutron generators the angular distribution of elastically scattered neutrons at energies of 3 and 14 Mev. The continuation of this research is planned for 1960, as well as the study of neutron polarization.

Further development was devoted to studies of nuclear matter and nuclear dynamics. The computation of collective nuclear excitations of matter was carried out on the basis of the superconductivity theory by N. N. Bogolyubov. On the basis of the same theory, B. B. Dotsenko and Yu. V. Tsekhmistrenko computed the energy of the ground state and of elementary excitations of superfluid nucleon gas.

A. M. Korolev developed the theory of stripping reactions on the basis of the generalized nuclear model for even-even nuclei.

The development of various equipment was also undertaken in the institute. Among other items, a multichannel amplitude analyzer with a magnetic memory, low voltage neutron generators, a device for conversion from the binary system into the decimal, scintillation gamma spectrometers, a neutron spectrometer, and spectrometers of charged particles were constructed.

150. Soviet Research Reactor

"Design of the VVR-S Research Reactor," by V. F. Kozlov and M. G. Zemlyanskiy; Moscow, Atomnaya Energiya, Vol 8, No 4, Apr 60, pp 305-315

The VVR-S water-water reactor was built in the Soviet Union for peaceful atomic energy research. Such reactors are constructed and exploited in the Soviet Union and other socialistic countries. Six such reactors became critical in 1957-1959; five reactors (four with forced power) are in stages of construction, assembly, and testing. The VVR-S reactor and its experimental construction are described. The physical characteristics of the reactor were given in Atomnaya Energiya, Vol 5, No 1, 1958, page 44, by N. A. Lazunov, I. Ye. Chelnokov, and V. P. Ivanov.

151. Plasma Motion

"Motion of Plasma in a Moving Magnetic Field," by V. G. Stepanov, V. F. Zakharchenko, and V. S. Bezel, Ural Polytechnic Institute imeni Kirov; Tomsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, No 1, 1960, pp 104-114

The problem of the motion of a charged particle in a rotating magnetic field is solved. It is shown that the analysis of motion of an ionized gas in a rotating magnetic field at a field frequency much below the Larmor frequency is possible in hydrodynamic approximation. On the basis of magnetohydrodynamic approximation, a centrifuge formula was derived. Experimental studies of the gas discharge in plasma in a rotating magnetic field confirmed the computations. It follows from an approximate evaluation of forces acting on the visually observable whirl that the whole gas is set into rotation similarly to a conducting liquid.

152. Resonance in Plasma

"Ionic Cyclotron Resonance in Dense Plasma," by L. V. Dubovoy, O. M. Shvets, and S. S. Ovchinnikov; Moscow, Atomnaya Energiya, Vol 8, No 4, Apr 60, pp 316-323

Possibilities of heating plasma by making use of the mechanism of ionic cyclotron resonance were investigated. It is shown that in plasmas with a charged particle density of 10^7 to 10^{11} cm^{-3}, the application of short (in comparison with the length of the plasma pinch) heating sections permits lowering the effect of cross-section ionic polarizing fields on account of electron discharge motion along the force lines of the external magnetic field. In a plasma with a low ionization degree, a strong weakening of the efficiency of transfer of ultrahigh frequency field energy to ions may be observed with increasing ion velocities, related to ion cooling by neutrals.

153. Longitudinal Plasma Oscillations

"Instability of Longitudinal Oscillations of an Electron-Ion Plasma," by L. M. Kovrizhnikh and A. A. Rukhadze, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 3, Mar 60, pp 850-853

The problem of instability of longitudinal oscillations of a low temperature electron-ion plasma is considered. The oscillations are always damped in an isotropic medium, whereas in an anisotropic one, taking account of the ion motion may lead to the appearance of solutions which increase with time, that is, to instability.

154. Interaction of an Electron Beam and Plasma

"Investigation of the Interaction Between an Electron Beam and Plasma," by I. F. Kharchenko, Ya. B. Faynberg, R. M. Nikolayev, Ye. A. Kornilov, Ye. A. Lutsenko, and N. S. Pedenko, Physicotechnical Institute, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 3, Mar 60, pp 685-692

Results of an experimental investigation of the interaction between a modulated and unmodulated beam of high energy electrons and high frequency discharge plasma are presented. It is shown, that when the unmodulated beam moves through the plasma, oscillations arise in the beam which possess a frequency close to that of the plasma. The dependence of the oscillation amplitude on the frequency and parameters of the plasma has been determined. Coherent energy losses of electrons in a modulated and unmodulated beam passing through the plasma have been investigated.

155. Absorption Resonance in Plasma

"Gyroresonance Absorption of Electromagnetic Waves in a Plasma," by B. N. Gershman, Radiophysics Institute, Gor'kiy State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 3, Mar 60, pp 912-924

Absorption of normal waves in an homogeneous, magnetoactive plasma is determined with account of thermal motion of the electrons in a frequency range lying near the gyrofrequency and multiple frequencies. Collisions, as well as the absorption mechanism specific of the plasma, are taken into account.

Solid State Physics

156. Percussive Recombination in Semiconductors

"Theory of Percussive Recombination in Semiconductors," by V. L. Bonch-Bruyevich and Yu. V. Gulayev, Institute of Radio Engineering and Electronics, Academy of Sciences USSR, Moscow; Leningrad, Fizika Tverdogo Tela, Vol 2, No 3, Mar 60, pp 465-473

Percussive recombination in semiconductors is studied with allowance for interaction between free current carriers. It is attempted to evaluate the value of the exchange term at capture of nonbasic carriers and to take into account the effect of coulomb forces at capture by charged centers.

157. Electron Reflection

"Characteristic Energy Losses in the Reflection of Electrons From Single Crystals of Alkali-Haloid Compounds," by M. L. Kapitsa, S. A. Fridrikhov, and A. R. Shulman, Leningrad Polytechnic Institute; Leningrad, Fizika Tverdogo Tela, Vol 2, No 3, Mar 60, pp 517-523

The theory of fine structure of distribution curves of secondary electrons according to energies for single crystals of alkali-haloid compounds, started in Zhurnal Tekhnicheskoy Fiziki, Vol 25, 1344 (1955), is further developed. It is shown that the structure consists of two systems of maxima, one of which is connected to characteristic energy losses of the electrons. A correlation between these energy losses and optical data is revealed.

158. Conversion of Thermionic Emission

"Application of Thermionic Emission for Direct Conversion of Heat Into Electric Energy," by N. D. Morgulis and A. G. Naumovets, Institute of Physics, Academy of Sciences Ukrainian SSR, Kiev; Leningrad, Fizika Tverdogo Tela, Vol 2, No 3, Mar 60, pp 537-542

Work reported earlier by N. Morgulis and P. Marchuk ("Study of Thermionic Devices With Cesium Vapors," Otchet IF AN USSR /Account of the Institute of Physics/, 1949) is further developed. It is attempted to directly convert thermal energy into electrical energy by means of thermionic emission of an active metal-film cathode (L-cathode) in cesium vapors. Use is made of the partial compensation of the electron space charge by Cs ions produced as a result of thermal ionization on sections of the metal of the cathode surface stripped of the film. In this way, it is possible to obtain a noticeable short-circuited electron current, as well as a noticeable energy efficiency of such conversion. This kind of study of thermal ionization can also be used for studying the character of adsorption inhomogeneities of various film-type cathodes.

159. Photocells With p-n Junction

"Theory of Photocells With p-n Junction," by B. Ya. Moyzhes, Institute of Semiconductors, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 2, No 2, Feb 60, 221-226

It is shown that the distribution of the resistance of the photoconductive layer when the voltage drop exceeds kT/q decreases by a factor of two the slope of the dark volt-ampere characteristic in coordinates $\log I = f(V)$ and makes the load characteristic more inclined. The effect of the electric field and the decrease of the mobility in the diffusion layer on the quantum yield of the photocell are analyzed; these factors act in different directions and partially compensate each other.

"Determination of Recombination Constants From Spectral Characteristics of a Photocell With a p-n Junction," by V. K. Subashiyev, Institute of Semiconductors, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 2, No 2, Feb 60, pp 205-212

An analysis of the spectral characteristics of a photocell with a p-n junction is carried out by using the formulas derived by G. L. Bir and G. Ye. Pikus (ZhTF, 27, 467 (1957)). A method of applying experimental data, permitting recombination constants and the depth of location of the p-n junction to be obtained, is presented, using the spectral characteristics.

Spectroscopy

160. Absorption of Ultraviolet Radiation Behind a Shock Wave in Air

"On Absorption of Ultraviolet Radiation Behind a Shock Wave in Air," by S. A. Losev, N. A. Generalov, and L. B. Terebenina; Leningrad, Optika i Spektroskopia, Vol 8, No 4, Apr 60, pp 569-571.

Absorption of ultraviolet light by the heated air behind the front of a descending shock wave in a shock tube was investigated. Measurements were carried out within intervals of 9-18 $\mathring{A}$ in the wave-length range of 2250-3400 $\mathring{A}$. The absorptive capacity was correlated with the wave length at conditions more or less constant with respect to the temperature and pressure. It was established that the absorptive capacity decreases with increasing wave lengths. The experimental data show that there is significant absorption of ultraviolet radiation over a distance of 5 centimeters by air heated as a result of the passage of a shock wave. The absorptive capacity increases with the pressure and the temperature; the absorption shifts to longer wave lengths as the pressure and temperature increase. The absorption which has been observed is ascribed to oxygen and nitrogen oxide /NO/.

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